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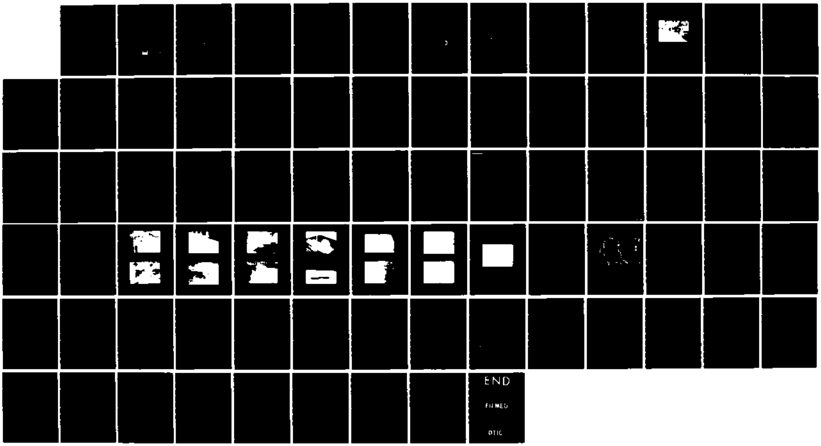

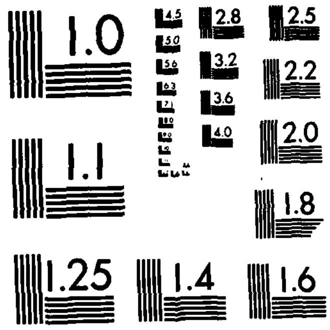

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

CONNECTICUT RIVER BASIN
HARRISVILLE, NEW HAMPSHIRE

CHESHAM POND DAM
NH 00063

STATE NO 109.02

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

MARCH 1980

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

DAMS, INSPECTION, DAM SAFETY,

Connecticut River Basin
Harrisville, New Hampshire
Minnewawa Brook

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The dam is a concrete gravity dam and earthen embankment 125 ft. long and 16 ft. high. The dam is in fair condition. It is small in size with a significant hazard classification. A breach in the dam could cause potential for loss of 1-2 lives and appreciable property damage. There are various major concerns which must be corrected to assure the continued performance of the dam.

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF:
NEDED

JUN 19 1980

Honorable Hugh J. Gallen
Governor of the State of New Hampshire
State House
Concord, New Hampshire 03301

Dear Governor Gallen:

Inclosed is a copy of the Chesham Pond Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Water Resources Board, the cooperating agency for the State of New Hampshire. In addition, a copy of the report has also been furnished the owner, the State of New Hampshire.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Water Resources Board for your cooperation in carrying out this program.

Sincerely,

MAX B. SCHEIDER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT

Identification No.:	NH00063
Name of Dam:	Chesham Pond Dam
Town:	Harrisville
County and State:	Cheshire County, New Hampshire
Stream:	Minnewawa Brook
Date of Inspection:	September 13, 1979

BRIEF ASSESSMENT

Chesham Pond Dam is a concrete gravity dam and earthen embankment 125 feet in length with a hydraulic height of 16 feet. The spillway consists of a concrete ogee spillway 41 feet in length. A concrete sluiceway structure is adjacent to the northwest end of the spillway and contains a gate-operated low-level outlet 2'H x 3.5'W. The gate is operated by a hand operated mechanism located directly above the gate. A highway crossing is located just downstream of the dam. Stone masonry training walls are located on either side of the spillway discharge channel and terminate against the highway embankment. The dam spans Minnewawa Brook and is located in southwest New Hamphshire. The drainage area above the dam is 8.2 square miles and contains Silver Lake, Childs Bog, and Seaver Reservoirs. Maximum storage capacity is approximately 630 acre-feet. Normal pool is approximately 0.55 miles in length with a surface area of 70 acres. Chesham Pond is currently used for recreational purposes.

The dam is in fair condition. Major concerns are: inadequate spillway capacity, deterioration of the mortar in the stone masonry training walls on both sides of the discharge channel between the dam and the highway embankment, lack of vegetation and erosion resistance on the upstream slope of the embankment section near the southeast end of the dam, and trees growing on the upstream and downstream slopes of the dam.

The dam is of small size and significant hazard classification based on storage volume and potential for loss of 1-2 lives and appreciable property damage in event of a breach. In accordance with the Recommended Guidelines for Safety Inspection of Dams, the test flood may range from the 100-year to ½ the Probable Maximum Flood (PMF). A test flood equal to ½ PMF was selected because of the potential for loss of 1-2 lives in the event of a breach. To determine the test flood outflow, the Seaver Reservoir Dam Phase I Inspection Report was consulted. The drainage area to Seaver Dam is 4.4 square miles and the resulting test flood outflow (½ PMF) was determined to be 2,660 cfs. The subdrainage area to Chesham Pond Dam is 3.8 square miles of steeply sloping terrain (166 ft/mile). Using the PMF Peak Flow Rates graph, the peak discharge for a 'mountainous' watershed, having a drainage area of 3.8 square miles, was determined to be 8,740 cfs. Therefore, the test flood inflow from the subdrainage area would be 4,370 cfs. Using the ½ PMF discharge from Seaver Reservoir Dam of 2,660 cfs and the test flood inflow from the subdrainage area of 4,370 cfs, the total test flood inflow to Chesham

Pond Dam was determined to be approximately 7,000 cfs (854 csm). It should be noted that the peaks for the test flood outflow from Seaver Reservoir Dam and the inflow from the subdrainage area would probably not occur at the same time. However, for the purposes of this Phase I investigation, the test flood inflow will be assumed to equal the summation of these two values. Using the procedure outlined in Estimating Effect of Surcharge Storage on Maximum Probable Discharges issued by the Corps, to determine the modifying effect of surcharge storage on the test flood inflow, the routed test flood outflow was determined to be 6,000 cfs (732 csm) at elevation 1161.2' NGVD. The test flood analysis indicates that the dam would be overtopped by 4.8 feet during the test flood. Maximum spillway capacity at top of dam is 535 cfs which is 9 percent of the routed test flood outflow.

The owner, the New Hampshire Water Resources Board, should implement the results of the recommendations and remedial measures given in Sections 7.2 and 7.3 within one year after receipt of this Phase I Inspection Report.

Warren A. Guinan

Warren A. Guinan
Project Manager
N.H. P.E. 2339

This Phase I Inspection Report on Chesham Pond Dam **has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.**

Richard J. DiBuono

RICHARD DIBUONO, MEMBER
Water Control Branch
Engineering Division

Aramast Mahtesian

ARAMAST MAHTESIAN, MEMBER
Foundation & Materials Branch
Engineering Division

Carney M. Terzian

CARNEY M. TERZIAN, CHAIRMAN
Design Branch
Engineering Division

APPROVAL RECOMMENDED:

Joe B. Fryar

JOE B. FRYAR
Chief, Engineering Division

PREFACE

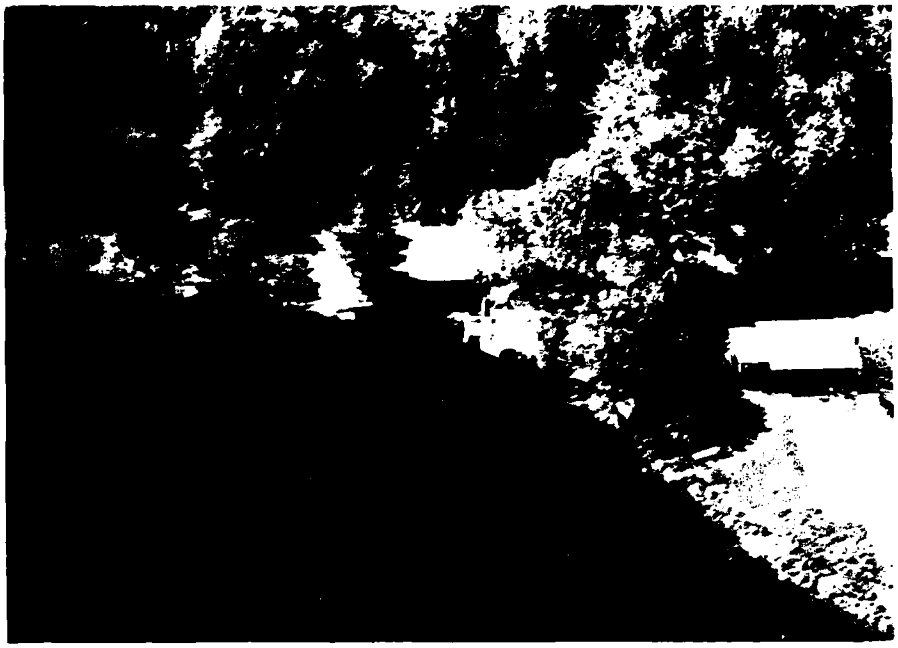
This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

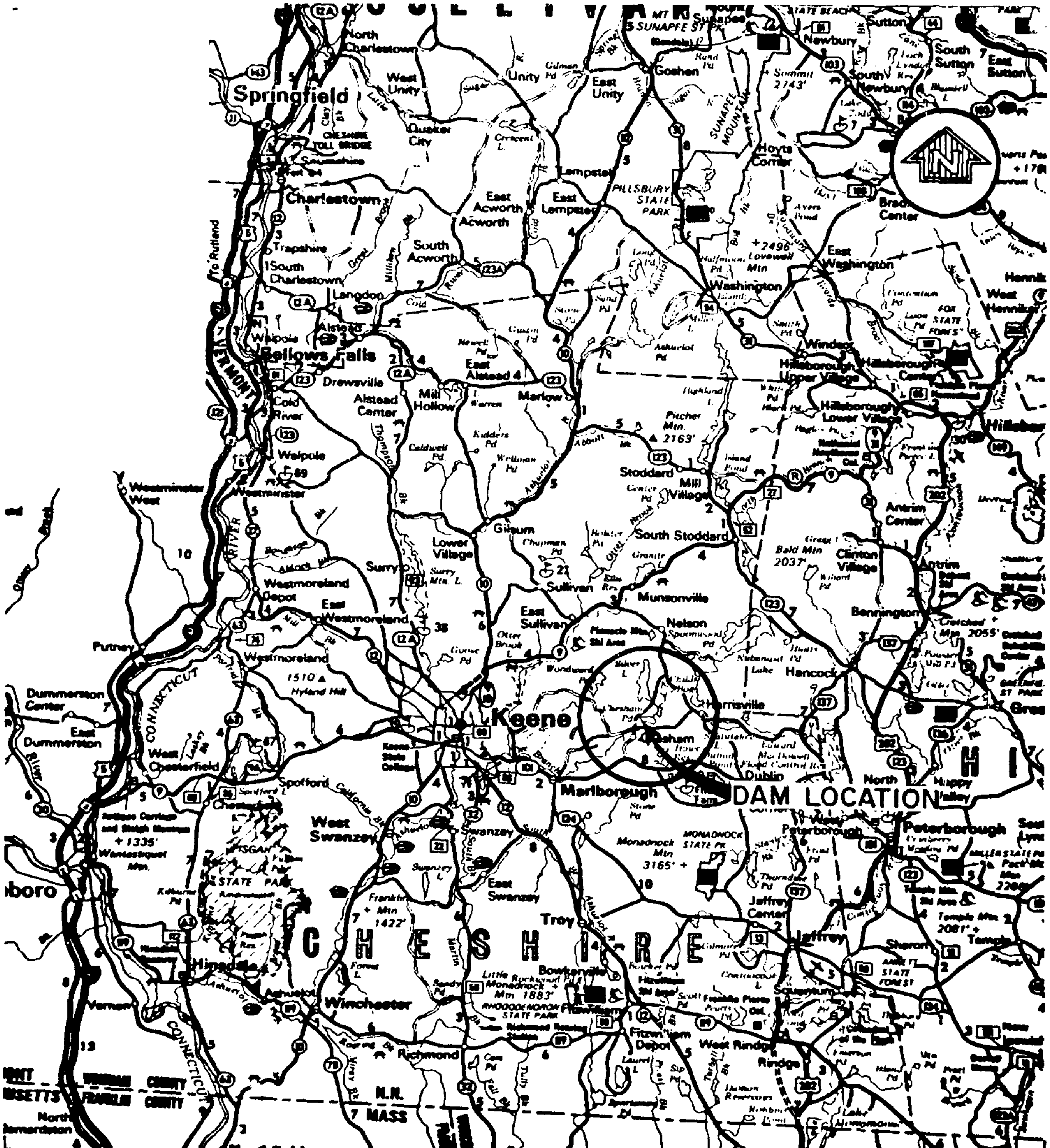
Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

TABLE OF CONTENTS



June 1979

Figure 1 - Overview of Chesham Pond Dam.



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SCALE IN MILES

0 5 10

MAP BASED ON STATE OF NEW HAMPSHIRE OFFICIAL HIGHWAY MAP.

Anderson-Nichols & Co., Inc. CONCORD NEW HAMPSHIRE	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

CHESHAM POND DAM LOCATION MAP

MINNEWAWA BROOK NEW HAMPSHIRE

SCALE: SEE BAR SCALE

DATE: MARCH 1980

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT
CHESHAM POND DAM

SECTION 1
PROJECT INFORMATION

1.1 General

a. Authority. Public Law 92-367, August 8, 1972 authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Anderson-Nichols & Company, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of New Hampshire. Authorization and notice to proceed were issued to Anderson-Nichols under a letter of March 22, 1979 from John P. Chandler, Colonel, Corps of Engineers. Contract No. DACW33-79-C-0050, as changed, has been assigned by the Corps of Engineers for this work.

b. Purpose

(1) To perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.

(2) To encourage and prepare the States to initiate quickly effective dam safety programs for non-Federal dams.

(3) To update, verify and complete the National Inventory of Dams.

1.2 Description of Project

a. Location. Chesham Pond Dam is located in the Town of Harrisville, New Hampshire and impounds a reservoir of small size. Chesham Dam is the downstream dam in a series of four dams which impound the headwaters of Minnewawa Brook. After discharging at damsite, Minnewawa Brook flows southwesterly approximately 7 miles to its confluence with Otter Brook to form The Branch. The Branch then continues another 2.5 miles to Keene, New Hampshire where it joins the Ashuelot River. The Ashuelot River is a major tributary in the Connecticut River Basin. Chesham Pond Dam is shown on U.S.G.S. Quadrangle, Monadnock, New Hampshire with coordinates approximately at N42°56'15", W72°08'23", Cheshire County, New Hampshire. (See Location Map page viii.)

b. Description of Dam and Appurtenance. Chesham Pond Dam is a concrete gravity dam and earthen embankment 125 feet in length with a hydraulic height of 16 feet. Beginning at the southeast end of the dam and going northwest the dam consists

APPENDIX A

VISUAL INSPECTION CHECKLIST

(5) Inspect the spillway when no water is flowing over t for evidence of leakage or undermining.

he owner should carry out the recommendations made by the engineer.

.3 Remedial Measures

a. Operating and Maintenance Procedures. The owner should:

(1) Clear trees for a distance of 25 feet on either side f the discharge channel between the dam and the highway that rosses the channel downstream of the dam.

(2) Remove trees from the shore of the pond for a distance f 100 feet upstream from the intake to the low-level outlet at the est end of the dam.

(3) Repair the spalled concrete at the southeast abutment all.

(4) Visually inspect the dam and appurtenant structures nce a month.

(5) Engage a professional engineer qualified in the design nd construction of dams to make a comprehensive technical inspection f the dam once every year.

(6) Establish a surveillance program for use during and mmediately after heavy rainfall and also a downstream warning rogram to follow in case of emergency conditions.

(7) Establish trespassing control.

(8) Ensure operation of low-level outlet.

.4 Alternatives

one.

SECTION 7
ASSESSMENT, RECOMMENDATIONS, AND REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition. The visual examination indicates that Chesham Pond Dam is in fair condition. The major concerns with respect to the integrity of the dam are:

(1) Inadequate spillway capacity.

(2) Deterioration of the mortar in the stone masonry training walls on both sides of the discharge channel between the dam and the highway embankment which crosses the channel downstream of the dam.

(3) Lack of vegetation and erosion resistance on the upstream slope of the embankment section near the southeast end of the dam.

(4) Trees growing on the upstream and downstream slopes of the dam.

b. Adequacy of Information. The information from the visual inspection and hydraulic analyses is adequate to identify the problems listed in 7.2. These problems will require the attention of a professional engineer who will have to make additional engineering studies to design or specify remedial measures. No additional information is needed for the purposes of this Phase I investigation.

c. Urgency. The owner should implement the recommendations in 7.2 and 7.3 within one year after receipt of this Phase I report.

7.2 Recommendations

The owner should retain a professional engineer qualified in the design and construction of dams to:

(1) Perform a more detailed investigation to evaluate spillway adequacy and overtopping potential.

(2) Specify procedures for repair of the stone masonry training walls on both sides of the discharge channel between the dam and the highway embankment that crosses the channel downstream of the dam.

(3) Specify procedures for providing adequate erosion resistance on the upstream slope of the embankment section of the dam.

(4) Specify and oversee procedures for removing trees and their root systems from the embankment section of the dam. Also specify and oversee the filling of the voids remaining from the root system removal.

SECTION 6
STRUCTURAL STABILITY

6.1 Visual Observations

The visual examination indicates the following potential structural problems:

(1) Deterioration of the mortar in the stone masonry training walls on both sides of the discharge channel between the dam and the highway embankment which crosses the channel downstream of the dam.

(2) Lack of vegetation and erosion resistance on the upstream slope of the embankment section near the southeast end of the dam.

(3) Trees growing on the upstream and downstream slopes of the embankment section which could cause seepage or erosion problems if a tree blows over and pulls out its roots or if a tree dies or is cut and its roots rot.

6.2 Design and Construction Data

In a letter dated June 30, 1949, it is stated that the contractor who built the original dam in 1921 stated "that most of this dam is built of very large boulders... (and) the bottom of this dam was planked and there was some decay there."

6.3 Post-Construction Changes

A letter dated April 20, 1949 states that the dam "appears to be in a weak state and is in need of immediate repairs or reconstruction." A petition for repair dated September 6, 1949 states that the reconstruction will consist of "cement" {sic!}.

6.4 Seismic Stability

This dam is located in Seismic Zone 2 and, in accordance with the Phase I guidelines, does not warrant seismic analysis.

by the Corps, to determine the modifying effect of surcharge storage on the test flood inflow, the routed test flood outflow was determined to be 6,000 cfs (732 csm) at elevation 1161.2' NGVD. The test flood analysis indicates the dam would be overtopped by 4.8 feet during the test flood. Maximum spillway capacity at top of dam is 535 cfs which is 9 percent of the routed test flood outflow.

f. Dam Failure Analysis. The impact of failure of the dam with pool level at top of dam was assessed. Because of the tandem relationship of Childs Bog, Seaver and Chesham Dams, the three dams were analyzed through the use of the Corps of Engineers HEC-1DB computer program. With this analysis, it could be determined how much overtoppping would occur at each dam under various breach conditions. Since Chesham Pond Dam is the most downstream, the analysis of all these results is not necessary to determine the appropriate hazard classification for Chesham. Therefore, only the breach of Chesham will be discussed in this report.

A breach of Chesham Pond Dam was analyzed from the dam to a point about 1 mile downstream. The breach was assumed to occur at the top of dam and develop to the toe of the dam. The time for a breach to develop with a bottom width of 50 feet and sideslopes 1H:1V was estimated to be one hour. A breach of this magnitude resulted in a discharge of 6,960 cfs. One trailer located about 200 feet downstream of the dam could be inundated by 3.2 feet of water. This could cause damage to the structure and possibly cause loss of 1-2 lives. The road crossing, one-half mile downstream of the dam, could be overtopped by about 5.1 feet of water with a breach discharge of 6,470 cfs. Damage to the roadway and culvert could occur. Two houses located about 8 and 10 feet above streambed, just upstream from the road crossing, could be subjected to property damage. (See Appendix C - Figure 12.) The next road crossing, one mile downstream of the dam, could be overtopped by 3 feet with a breach discharge of 5,500 cfs. (See Appendix C - Figure 13.) This amount of overtopping could possibly damage the gravel roadway and culvert. The reach between these two road crossings provides a large storage area for attenuation of the breach wave. (See Appendix C - Figure 14.) One house in this reach, located about ten feet above the streambed, may be subjected to basement flooding.

A breach of Chesham Pond Dam could result in the possible loss of 1-2 lives and cause appreciable property damage. Based on this analysis, Chesham Pond Dam was classified Significant Hazard.

SECTION 5
HYDROLOGIC/HYDRAULIC

5.1 Evaluation of Features

a. General. Chesham Pond Dam is a concrete gravity dam which impounds a reservoir of small size. The drainage area to the damsite consists of 8.2 square miles of moderately to steeply sloping terrain. Silver Lake, Childs Bog, and Seaver Reservoir are storage areas in the upstream watershed. The total length of the dam is 125 feet with a hydraulic height of 16 feet. The concrete ogee spillway is 41 feet in length. A low-level outlet structure is located in the northwest abutment. A roadway is located immediately downstream of the dam. Discharge from the dam passes through the roadway in a corrugated metal pipe arch with a span of 14' 11" and rise of 10' 2".

b. Design Data. No design data were disclosed.

c. Experience Data. According to a letter dated October 13, 1938, Chesham Pond Dam had a flow of about 4 feet over the spillway crest during the flood of September 21-24, 1938. No other experience data was found.

d. Visual Observations. At the time of inspection, no visual evidence was noted of damage to any portions of the dam caused by excessive discharges.

e. Test Flood Analysis. Chesham Pond Dam is classified as being small in size, having a hydraulic height of 16 feet and a maximum storage capacity of 630 acre-feet. The dam was determined to have a significant hazard classification. Using the Recommended Guidelines for Safety Inspection of Dams, the test flood may range from the 100-year to ½ the Probable Maximum Flood (PMF). A test flood equal to ½ PMF was selected because of the potential for loss of 1-2 lives in the event of a breach. To determine the test flood inflow, the Seaver Reservoir Dam Phase I Inspection Report was consulted. The drainage area to Seaver Dam is 4.4 square miles and the resulting test flood outflow (½ PMF) was determined to be 2,660 cfs. The subdrainage area to Chesham Pond Dam is 3.8 square miles of steeply sloping terrain (166 ft/mile). Using the PMF Peak Flow Rates graph, the peak discharge for a 'mounainous' watershed, having a drainage area of 3.8 square miles, was determined to be 8,640 cfs. Therefore, the test flood inflow from the subdrainage area would be 4,370 cfs. Using the ½ PMF discharge from Seaver Reservoir Dam of 2,660 cfs and the test flood inflow from subdrainage area of 4,370 cfs, the total test flood inflow to Chesham Pond Dam was determined to be approximately 7,000 cfs (854 csm.) Using the procedure outlined in Estimating Effect of Surcharge Storage on Maximum Probable Discharges issued

SECTION 4
OPERATIONAL PROCEDURES

4.1 Procedures

Chesham Pond Dam is owned and operated by the New Hampshire Water Resources Board (NHWRB). The normal recreational lake level is maintained at the permanent spillway crest during the summer season. The lake level is lowered in the fall by use of the low-level outlet to provide storage for spring runoff and to enable property owners to make shoreline improvements.

4.2 Maintenance of Dam

NHWRB is responsible for the maintenance of the dam.

4.3 Maintenance of Operating Facilities

Throughout the year, the dam is visited on a weekly basis by a maintenance staff member of the NHWRB. A weekly log is kept on conditions at the dam site. The gate was not operated during the inspection; however, the mechanism appeared to be in satisfactory condition but has surface rust.

4.4 Description of Any Warning System in Effect

No written warning system was disclosed.

4.5 Evaluation

The current operation and maintenance procedures, consisting of a weekly program of inspection, should ensure that all minor problems encountered can be remedied within a reasonable period of time.

Some trees have grown on the upstream slope of the embankment section near the abutment and also on the downstream slope near the training wall on the east side of the channel. (See Appendix C - Figure 6.) No seepage was observed on the downstream embankment section of the dam.

c. Appurtenant Structures. The concrete low-level outlet structure at the northwest end of the spillway is approximately 4.5' wide and supports the sluice gate operating mechanism and wooden racks. (See Appendix C - Figure 7.) The concrete was observed to be in good condition with only a minor hair line crack in the concrete wall at one corner and only minor surface erosion of the concrete at the water line. The wooden decking over the sluice way channel was observed to be in good condition with only minor evidence of weathering and warping. The gate operating mechanism, which is a hand operated racket type, was observed to be in fair condition with some surface rust. (See Appendix C - Figure 8.) There was no indication of recent lubrication or operation. The trash racks which have been constructed of 2x4 wood members, were observed to be weathered.

d. Reservoir. The watershed above the reservoir is moderately to steeply sloping and heavily wooded. (See Appendix C - Figure 9.) The slopes of the reservoir appear stable. No evidence of significant sedimentation was observed. There are some trees overhanging the edge of the pond immediately upstream from the intake to the low-level outlet.

e. Downstream Channel. A roadway is located 20 feet downstream of the dam. (See Appendix C - Figure 10.) The channel downstream of the culvert is tree lined on both banks. (See Appendix C - Figure 11.)

3.2 Evaluation

On the basis of the results of the visual inspection, Chesham Pond Dam is considered to be in fair condition.

Deterioration of the mortar between the stone blocks in the stone masonry training walls on both sides of the discharge channel between the dam and highway immediately downstream could lead to failure of the walls and subsequent failure of the soil abutments of the dam.

The lack of vegetation on the upstream slope of the embankment section near the east end of the dam has led to some erosion, if allowed to continue, could result in breaching of the dam.

Trees growing on the upstream and downstream slopes of the embankment section of the dam could cause seepage or erosion problems if a tree blows over and pulls out its roots or if a tree dies or is cut and its roots rot.

SECTION 3
VISUAL INSPECTION

3.1 Findings

a. General. Chesham Pond Dam is a low dam which impounds a reservoir of small size. The watershed above the reservoir is moderately to steeply sloping and heavily wooded. The downstream area is moderately sloping. From the southeast end of the concrete gravity section to the southeast abutment (which is not clearly defined) there is an embankment section about 65 feet long.

b. Dam. Chesham Pond Dam is a concrete gravity dam with a hydraulic height of 16 feet and totaling 125 feet in length. (See Appendix C-Figures 2 and 3.) The downstream face of the spillway is inclined at 1H:1V.

Both abutments of the dam consist of soil. There are many large boulders at the downstream toe of the dam, but no evidence near the dam of anything that appears to be bedrock. No information was found in the available records as to whether the dam is founded on bedrock or soil. Therefore, it is not possible to conclude what material the dam is founded on.

Water was flowing over the dam at the time of the inspection. As a result it is not possible to determine whether any leakage is taking place under the dam.

Stone masonry training walls are located on either side of the discharge channel between the dam and the roadway culvert about 20 feet downstream. The mortar between the stone blocks in these training walls is badly deteriorated. No water was leaking through these walls above tailwater except for one leak at an elevation 0.6 foot below pond level where the training wall on the east side of the channel meets the stone masonry wall which retains the highway fill. (See Appendix C-Figure 4.) It is considered unlikely that this leakage is coming from the pond.

The concrete weir was observed to be in good condition with minor surface erosion of the concrete at the water line. The training wall (abutment) at the southeast end of the weir was eroded and spalled up to 2" deep. (See Appendix C-Figure 5.)

The upstream slope of the embankment section has very little vegetation near the southeast end of the dam (apparently this is due to trespassing) and has experienced some erosion.

SECTION 2
ENGINEERING DATA

2.1 Design

No original design plans were found for Chesham Pond Dam. Plans for repairs in 1949 were found in the files of the New Hampshire Water Resources Board (NHWRB).

2.2 Construction Records

No construction records were revealed.

2.3 Operation

No engineering operational data were found.

2.4 Evaluation

a. Availability. A search of the files of the NHWRB revealed the plans of repairs in 1949 and other general historical information which was utilized in the preparation of this report.

b. Adequacy. The information obtained from the files of the NHWRB was used in conjunction with the visual inspection and the hydrologic and hydraulic computations to make the final assessments and recommendations of this investigation.

c. Validity. The structure as seen on the visual inspection is in close conformity to the disclosed plans and information.

(7) Impervious core - unknown

(8) Cutoff - unknown

(9) Grout curtain - unknown

h. Diversion and Regulating Tunnel - not applicable (See j. below.)

i. Spillway

(1) Type - concrete gravity ogee spillway with a sloping downstream face (1H:1V).

(2) Length of weir - 41'

(3) Crest elevation - 1154' NGVD (See 1.3 c (6) above)

(4) Gates - none

(5) U/S Channel - Numerous cottages and homes are located around the reservoir. The reservoir slopes are wooded. No significant sedimentation at the damsite was observed.

(6) D/S Channel - About 20 feet downstream from the spillway apron is a roadway crossing. Discharge over the spillway passes through the roadway in a corrugated metal pipe arch with a span of 14' 11" and rise of 10'2".

j. Regulating Outlets. There is one 2.0'H x 3.5'W low-level opening located in the sluiceway structure adjacent to the northwest end of the spillway. This opening is controlled by a CI sluice gate. The invert of the opening is at elevation 1146.6' NGVD.

(6) Spillway crest - 1154 (Shown on USGS Quadrangle Sheet and assumed to be spillway crest elevation.)

(7) Original design surcharge - unknown

(8) Top of dam - 1156.4

(9) Test flood pool - 1161.2

d. Reservoir Length (miles)

(1) Maximum pool - 0.57

(2) Spillway crest pool - 0.55

(3) Flood control pool - not applicable

e. Storage (acre-feet)

(1) Recreation pool - 460

(2) Flood control pool - not applicable

(3) Spillway crest pool - 460

(4) Top of dam - 630

(5) Test flood pool - 1140

f. Reservoir Surface Area (acres)

(1) Recreation pool - 70

(2) Flood control pool - not applicable

(3) Spillway crest - 70

(4) Test flood pool - 115

(5) Top of dam - 84

g. Dam

(1) Type- concrete gravity dam with earth embankment

(2) Length - 125'

(3) Height - 16' (structural and hydraulic)

(4) Topwidth - varied

(5) Side slopes - varied

(6) Zoning - unknown

The lake level is lowered in the fall by use of the low-level outlet. Throughout the year, the dam is visited on a weekly basis by a maintenance staff member of the NHWRB. A weekly log is kept on conditions at the damsite.

1.3 Pertinent Data

a. Drainage Area. .he drainage area consists of 8.2 square miles (5,248 acres) of moderately to steeply sloping terrain. Silver Lake, Childs Bog and Seaver Reservoir are located in the upstream watershed. The normal pool of Chesham Pond has a surface area of 70 acres which constitutes 1 percent of the watershed.

b. Discharge at Damsite

(1) Outlet works - one 2.0'H x 3.5'W low-level opening controlled by CI sluice gate at invert elevation 1146.6' NGVD. Approximate capacity at top of dam - 120 cfs at 1156.4' NGVD.

(2) The maximum discharge at the damsite is unknown. However, a flow of 48 inches over spillway crest was reported during the flood of September 21-24, 1938. If this depth of flow over the spillway were to occur today, the approximate discharge would be 1,270 cfs with 1.6 feet of overtopping.

(3) Ungated spillway capacity at top of dam - 535 cfs @ 1156.4' NGVD

(4) Ungated spillway capacity at test flood elevation - 2,770 cfs @ 1161.2' NGVD

(5) Gated spillway capacity at top of dam - not applicable

(6) Gated spillway capacity at test flood elevation - not appliable

(7) Total spillway capacity at test flood elevation - 2,770 cfs @ 1161.2' NGVD

(8) Total project discharge at test flood elevation - 6,000 cfs @ 1161.2' NGVD

c. Elevation (ft. above NGVD of 1929; formerly called Mean Sea Level (MSL); see (6) below).

(1) Streambed at centerline of dam - 1140.8 (downstream invert pipe arch)

(2) Maximum tailwater - unknown

(3) Upstream gate invert - 1146.6

(4) Recreation pool - 1154

(5) Full flood control pool - not applicable

of the following sections: an earthen embankment 65 feet in length, a concrete spillway abutment, a concrete ogee spillway 41 feet long, and a concrete low-level sluiceway. The sluiceway structure contains a gate-operated mechanism located directly above the gate. The sluiceway intake is protected with a trash rack. A highway crossing is located just downstream of the dam. Discharge over the spillway passes through the roadway in a corrugated metal pipe arch with a span of 14'-11" and a rise of 10'2". Stone masonry training walls are located on either side of the spillway discharge channel and terminate against the highway embankment. The dam was originally constructed intregrally with a railroad embankment long since abandoned, but the bridge seats remain in the downstream training walls mentioned above.

c. Size Classification. Small (hydraulic height-16 feet; storage-630 acre - feet) based on storage (≥50 to <1000 acre - feet) as given in the Recommended Guidelines for Safety Inspection of Dams.

d. Hazard Classification. Significant hazard. A breach with pool at top of dam could result in the loss of 1-2 lives and cause appreciable property damage. For details see Section 5.1 f.

e. Ownership.Chesham Pond Dam was reported to have been built in 1921. The name of the original owner was not found. Ownership in 1930 was recorded to have been Breed Pond Company, in Marlborough, New Hampshire, formerly owned by Whitney. It is possible that Whitney was the original owner. Files from the New Hampshire Water Resources Board (NHWRB) indicate that the NHWRB took over ownership sometime between 1949 and 1968.

f. Operator. The current owner and operator of Chesham Pond Dam is the NHWRB. Mr. Vernon Knowlton, Chief Engineer, 37 Pleasant Street, Concord, New Hampshire 03301. Phone (603) 271-3406.

g. Purpose of Dam. The dam was previously used for storage purposes and is currently utilized for recreation.

h. Design and Construction History. According to the files at the NHWRB, the dam was originally built in 1921. No design or construction information was found regarding the original construction. The files also indicate the concrete spillway apron was constructed October 6, 1937. Plans of repairs made in 1949 were found. These plans were engineered and drawn by the Public Service Company of New Hampshire and dated August 9, 1949. Repairs included construction of the present sluiceway structure.

i. Normal Operating Procedures. The normal recreational level is maintained at the crest of the permanent spillway.

VISUAL INSPECTION CHECKLIST
PARTY ORGANIZATION

PROJECT CHESHAM POND DAM, N.H.

DATE September 13, 1979

TIME 9:30 AM

WEATHER Sunny, warm

W.S. ELEV.	U.S.	DN.S.
	1154' NGVD	1142.1' NGVD

PARTY:

1. Warren Guinan (ANCo)
2. Stephen Gilman (ANCo)
3. David Deane (ANCo)
4. Ronald Hirschfeld (GEI)
5.
6.
7.
8.
9.
10.

	PROJECT FEATURE	INSPECTED BY	REMARKS
1.	Hydrology/Hydraulics	D. Deane/W. Guinan	
2.	Structural Stability	S. Gilman	
3.	Soils and Geology	R. Hirschfeld	
4.			
5.			
6.			
7.			
8.			
9.			
10.			

PERIODIC INSPECTION CHECKLIST

PROJECT CHESHAM POND DAM, N.H. DATE Sept. 13, 1979

PROJECT FEATURE ________ NAME ________

DISCIPLINE ________ NAME ________

AREA EVALUATED	CONDITION
DAM EMBANKMENT	
Crest Elevation	
Current Pool Elevation	
Maximum Impoundment to Date	
Surface Cracks	None observed
Pavement Condition	Not paved
Movement or Settlement of Crest	None observed
Lateral Movement	None observed
Vertical Alignment	Good
Horizontal Alignment	Good
Condition at Abutment and at Concrete Structures	Trespassing and bare soil on upstream slope next to left end of spillway
Indications of Movement of Structural Items on Slopes	None observed
Trespassing on Slopes	See "Condition at Abutment..." above
Sloughing or Erosion of Slopes or Abutments	See "Condition at Abutment..." above
Rock Slope Protection - Riprap Failures	No riprap
Unusual Movement or Cracking at or Near Toe	None observed
Unusual Embankment or Downstream Seepage	None observed
Piping or Boils	None observed
Foundation Drainage Features	None observed
Toe Drains	None observed
Instrumentation System	None observed
Vegetation	Trees on upstream slope near left end of spillway

PERIODIC INSPECTION CHECKLIST

PROJECT CHESHAM POND DAM, N.H. DATE Sept. 13, 1979

PROJECT FEATURE ______ NAME ______

DISCIPLINE ______ NAME ______

AREA EVALUATED	CONDITION
OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE	
a. Approach Channel	
Slope Conditions	Not applicable
Bottom Conditions	Not visible beneath pond surface
Rock Slides or Falls	Not applicable
Log Boom	None
Debris	None
Condition of Concrete Lining	Not visible
Drains or Weep Holes	None
b. Intake Structure	
Condition of Concrete	Good; a little surface erosion of concrete at waterline
Stop Logs and Slots - Trashrack	Weathered wood

PERIODIC INSPECTION CHECKLIST

PROJECT CHESHAM POND DAM DATE Sept. 13, 1979

PROJECT FEATURE ______ NAME ______

DISCIPLINE ______ NAME ______

AREA EVALUATED	CONDITION
OUTLET WORKS - CONTROL TOWER	
a. Concrete and Structural	
General Condition	Good
Condition of Joints	Good-one hairline crack at change in direction of wall
Spalling	Minor erosion of concrete at water surface
Visible Reinforcing	None
Rusting or Staining of Concrete	Only at embedded items
Any Seepage or Efflorescence	None visible
Joint Alignment	Not applicable
Unusual Seepage or Leaks in Gate Chamber	None visible
Cracks	See "condition of joints" above
Rusting or Corrosion of Steel	Railings are painted-good Other items are surface eroded
b. Mechanical and Electrical	
Gate Operating Mechanism	Hand operated ratchet type, good condition-surface rust only. No indication of recent operation. Note: Wood decking over control tower is treated wood planking in fair condition; some evidence of weathering and warping.

PERIODIC INSPECTION CHECKLIST

PROJECT CHESHAM POND DAM DATE SEPTEMBER 13, 1979

PROJECT FEATURE ______ NAME ______

DISCIPLINE ______ NAME ______

AREA EVALUATED	CONDITION
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a. Approach Channel	
General Condition	Good.
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	Some trees at edge of pond immediately upstream of low-level outlet
Floor of Approach Channel	Not visible beneath pond surface
b. Weir and Training Walls	
General Condition of Concrete	Good
Rust or Staining	Only at embedded steel items
Spalling	Minor surface erosion of concrete of training walls at water surface. Left training wall-old concrete portion spalled and eroded.
Any Visible Reinforcing	None
Any Seepage or Efflorescence	None
Drain Holes	None
c. Discharge Channel	
General Condition	Fair
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	Trees overhanging channel between spillway and roadway and downstream of roadway.
Floor of Channel	Boulders
Other Obstructions	Culvert under roadway immediately downstream of spillway

APPENDIX B

ENGINEERING DATA

BREED POND COMPANY

Marlboro N. H.
June 30 1949

State of New Hampshire
Water Resources Board
Concord, N. H.

Attention Mr. Walter G. White

Dear Mr. White:

Supplimenting our letter of June 3rd. we wish to say that we have contacted the Contractor who built this dam in 1921 andhe has gone over it very carfully and states that most of this dam is built of very large boulders and could not possibly give way only on the top. The cause of the small leaks which were evident at the time of our last letter were in his estimation due to the fact that the bottom of this dam was planked and there was so me decay there.

This contractor is figuring out the best thing to do and will submit his report very soon.

In the mean time the water in this pond is down to a safe level due to the dry weather and the drawing from it for power purposes.

We will report more as soon as possible.

Very Truly yours,

Breed Pond Company

Robert C. Derby

Robert C. Derby /Clerk.

7205

NEW HAMPSHIRE WATER CONTROL COMMISSION
DATA ON RESERVOIRS & PONDS IN NEW HAMPSHIRE

LOCATION AT DAM NO. 109.02

Town Harrisville : County Cheshire

Stream Chesham Pond

Basin—Primary Connecticut : Secondary Minnewawa Brook

Local Name Symonds Reservoir

DRAINAGE AREA

Controlled ..... Sq. Mi.: Uncontrolled ..... Sq. Mi.: Total 8.15 Sq. Mi.

ELEVATION vs. WATER SURFACE AREA vs. VOLUME

Point	Head Feet	Surface Area Acres	Volume Acre Ft.
(1) Max. Flood Height			
(2) Top of Flashboards			
(3) Permanent Crest			
(4) Normal Drawdown	8	74.20	
(5) Max. Drawdown			
(6) Original Pond	1154 U S G S		

Base Used .....: Coef. to change to U.S.G.S. Base .....

RESERVOIR CAPACITY

	Total Volume	Useable Volume
Drawdown	ft.	ft.
Volume	ac. ft.	ac. ft.
Acre ft. per sq. mi.		
Inches per sq. mi.		

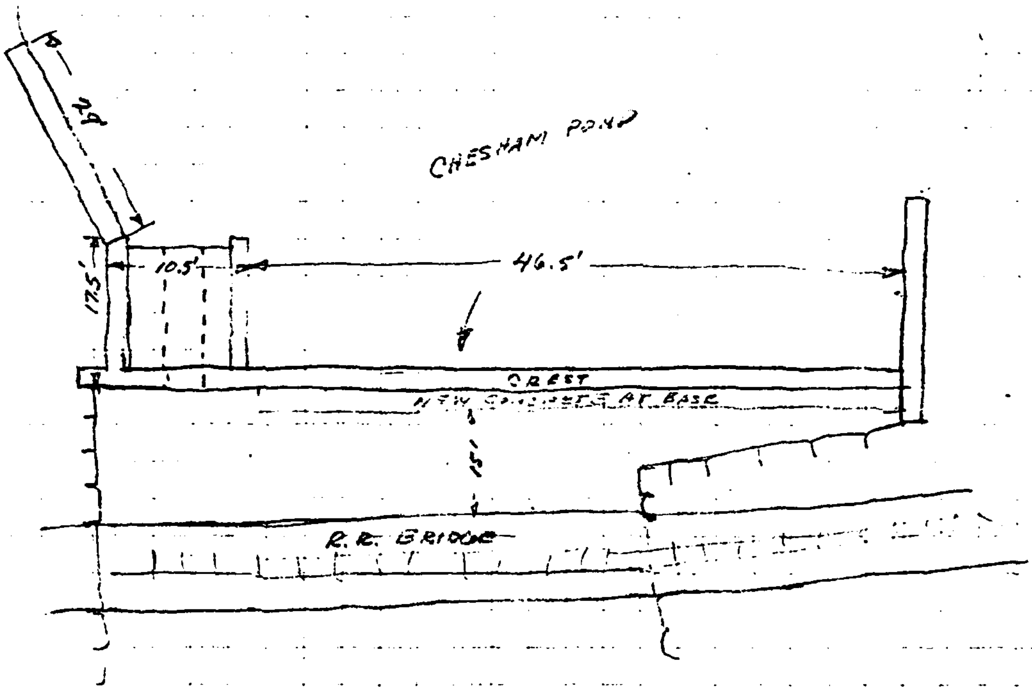
USE OF WATER Storage

OWNER Breed Pond Reservoir Co Harrisville N H

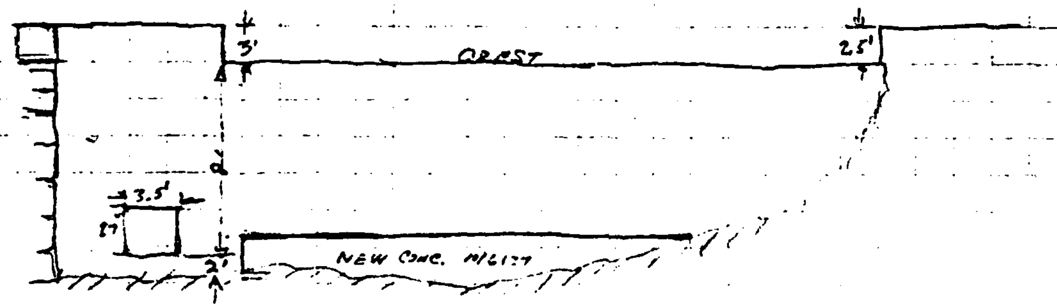
REMARKS Condition Good Wing Wall Badly Cracked

B-2

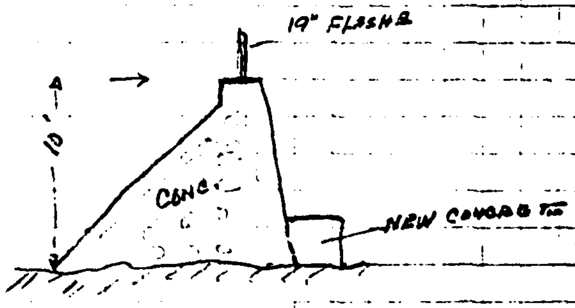
Tabulation By A. A. M. & R. L. T. Date December 9, 1938.



PLAN



PROFILE



X-SECTION

NEW HAMPSHIRE WATER CONTROL COMMISSION
DATA ON DAMS IN NEW HAMPSHIRE

LOCATION — STATE NO. 109.02

Town: Harrisville : County: Cheshire

Stream: Chesham Pond

Basin-Primary: Connecticut : Secondary: Minnewawa Brook

Local Name: Symonds Reservoir

Coordinates—Lat. 42° 55' + 3,600 : Long. 72° 10' -9,600

GENERAL DATA

Drainage area: Controlled .... Sq. Mi.: Uncontrolled .... Sq. Mi.: Total 8.15 Sq. Mi.

Overall length of dam 86 ft.: Date of Construction 1921

Height: Stream bed to highest elev. 13 ft.: Max. Structure 10.75 ft.

Cost—Dam .... : Reservoir ....

DESCRIPTION

Waste Gates

Type ....

Number 1 : Size 2.25 ft. high x 3.5 ft. wide

Elevation Invert 8' : Total Area 7.875 sq. ft.

Hoist ....

Waste Gates Conduit

Number .... : Materials ....

Size .... ft.: Length .... ft.: Area .... sq. ft.

Embankment

Type ....

Height—Max. .... ft.: Min. .... ft.

Top—Width .... : Elev. .... ft.

Slopes—Upstream .... on .... : Downstream .... on ....

Length—Right of Spillway .... : Left of Spillway ....

Spillway

Materials of Construction ....

Length—Total 46.5 ft.: Net .... ft.

Height of permanent section—Max. 10.2 ft.: Min. 10.15 ft.

Flashboards—Type .... : Height 19" ft.

Elevation—Permanent Crest .... : Top of Flashboard ....

Flood Capacity 605 cfs.: 75 cfs/sq. mi.

Abutments

Materials: ....

Freeboard: Max. 2.25 2.15 ft.: Min. .... ft.

Headworks to Power Devel.—(See "Data on Power Development")

OWNER Breed Pond Reservoir Co. Harrisville N H

REMARKS Storage

Tabulation By A. A. N. A. R. L. T. Date December 9, 1938.

B21284

Rec'd 10/15/38

Jacobson	
Holmgren	✓
Tolman	
Return to	
Filed	
File No.	

WATER CONTROL COMMISSION

STATE OF NEW HAMPSHIRE

Concord, New Hampshire

October 13, 1938.

Breed Pond Reservoir Co.,
Marlboro, N H

Known as Symonds Pond

RE: Chesham Pond Dam. W. C. C. No. 109.02

Gentlemen:

In order that we may determine the magnitude and extent of the flood of September 21-24 just passed, we are requesting the various dam owners in the State to supply us with the following information:

1. Was this dam injured? Ans. no

2. If so, to what extent? Ans.

3. Did all flashboards go out? Ans.

4. What was the maximum height of water over the permanent crest of spillway? Ans. Est. 48"

5. At what day and hour did the maximum flood height reach your dam? Ans.

6. Any other interesting information regarding the flood or rain fall may be given on the back of this sheet, or attach sheets.

Will you please return this letter with as much information as you can give us as promptly as possible. A self-addressed envelope is attached hereto.

We thank you for your cooperation.

Very truly yours,

Richard S. Holmgren

Richard S. Holmgren
Chief Engineer

CDC:GMB
Enc.

B-5

NEW HAMPSHIRE WATER RESOURCES BOARD

INVENTORY OF DAMS AND WATER POWER DEVELOPMENTS

DAM

BASIN *Connecticut* NO. *2* *109.02*
RIVER *Chesham Pond* MILES FROM MOUTH ______ D.A.SQ.MI *8.15*
TOWN *Harrisville* OWNER *[illegible] Co.*
LOCAL NAME OF DAM
BUILT *[illegible]* DESCRIPTION *Timber + Stone Concrete*

POND AREA-ACRES *[illegible]* DRAWDOWN FT. ______ POND CAPACITY-ACRE FT.
HEIGHT-TOP TO BED OF STREAM-FT. *10 13* MAX. ______ MIN. ______
OVERALL LENGTH OF DAM-FT. *50 86* MAX.FLOOD HEIGHT ABOVE CREST-FT. ______
PERMANENT CREST ELEV.U.S.G.S. ______ LOCAL GAGE ______
TAILWATER ELEV.U.S.G.S. ______ LOCAL GAGE ______
SPILLWAY LENGTHS-FT. *40 [illegible]* FREEBOARD-FT. *2.75 left [illegible]*
FLASHBOARDS-TYPE,HEIGHT ABOVE CREST *19"*

WASTE GATES-NO.	WIDTH	MAX.OPENING	DEPTH SILL BELOW CREST
1	*3.5*	*2.25*	*8*

REMARKS *Condition Good. Wingwall badly cracked. New concrete [illegible] Brook, Ashuelot. [illegible] about 2' up face + 15" thick at bottom [illegible]*

POWER DEVELOPMENT

UNITS NO.	RATED HP	HEAD FEET	C.F.S. FULL GATE	KW	MAKE

USE *Storage*

REMARKS *Selectmen call this Symonds Reservoir.*

DATE *1922 [illegible]*
10/7/37 [illegible]

To be inspected

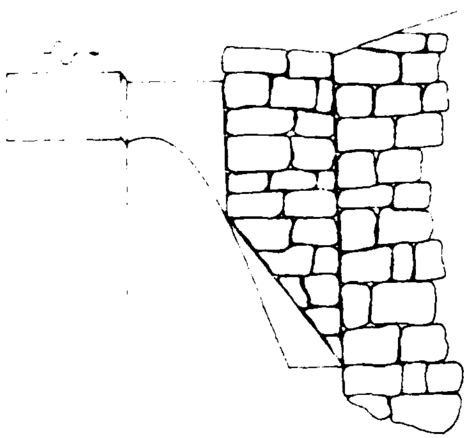
103 0%

Harrisville Inspected June 13, 1930.

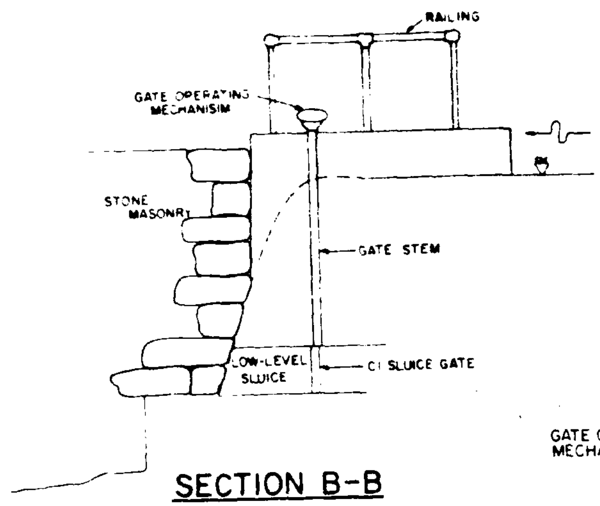
Simmonds Pond, also known as Chesham Pond, owned by Breeds Pond Association formerly owned by Whitney.

Small concrete dam built in 1921 near railroad and highway. The main dam seemed dry and in good condition. There were some small cracks on the west wing wall just east of the gate outlet. The west wing wall was quite badly cracked about sixteen feet from the gage board. No serious results however, as the earth back of the wing walls is in quite good condition.

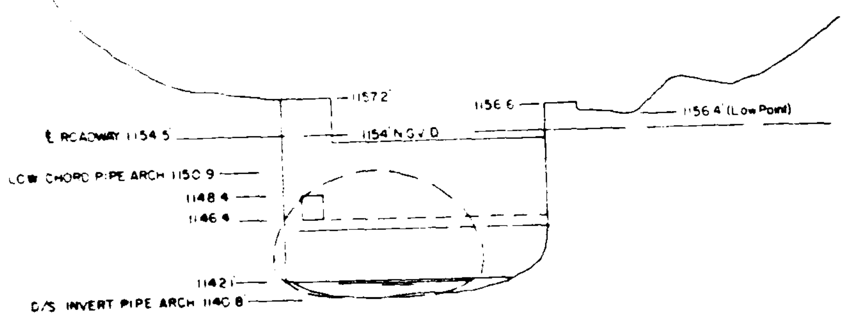
No picture.



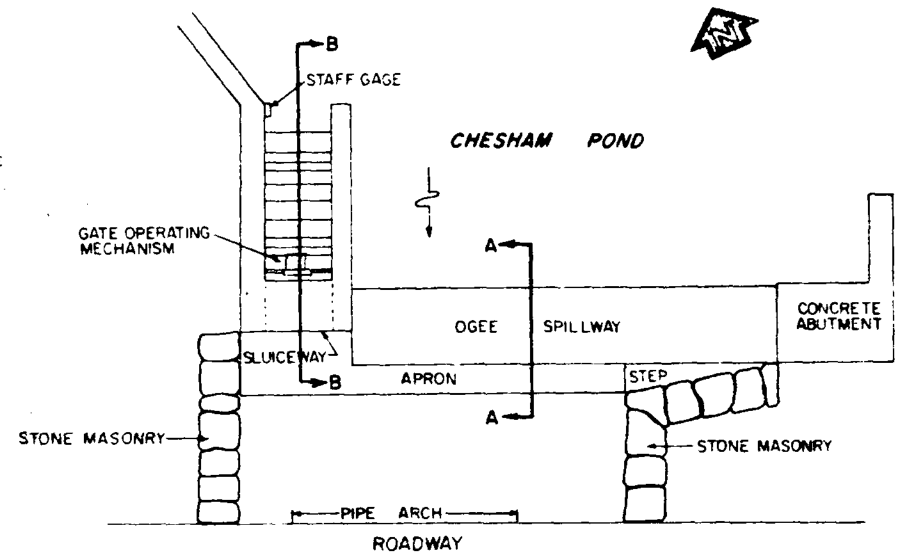
SECTION A-A



SECTION B-B



ELEVATION



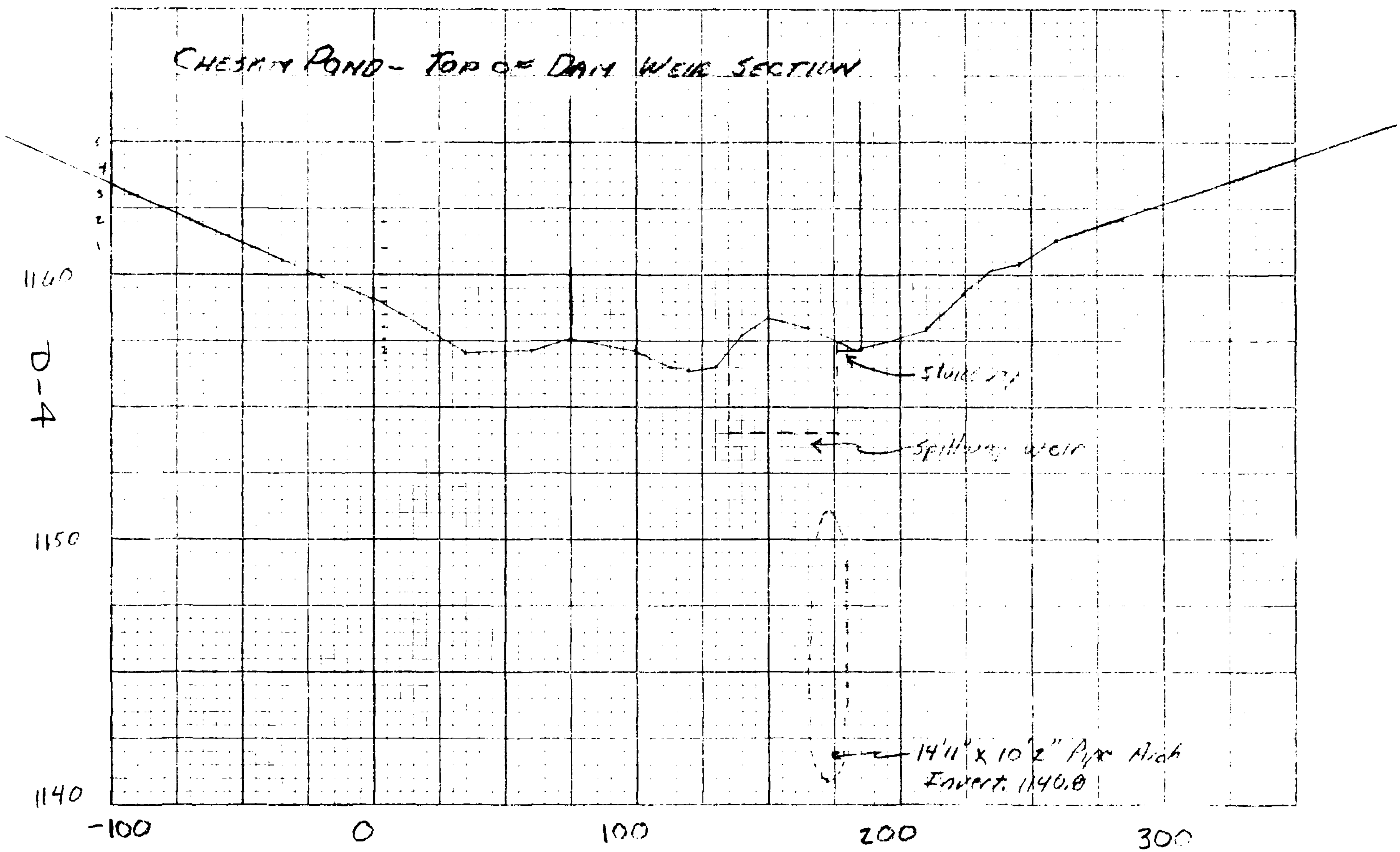
PLAN

NOTE: ALL ELEVATIONS ARE BASED ON SPILLWAY CREST ASSUMED ELEVATION OF 1154' N.G.V.D

Anderson-Nichols & Co., Inc. CONCORD NEW HAMPSHIRE	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MA

NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS

CHESHAM POND DAM


CHESHAM POND - TOP OF DAM WEIR SECTION
1160
1150
1140
-100
0
100
200
300
Sluiceway
Spillway weir
14'11" x 10'2" Pipe Arch
Invert 1140.0

-Nichols & Company, Inc.

JB NO.

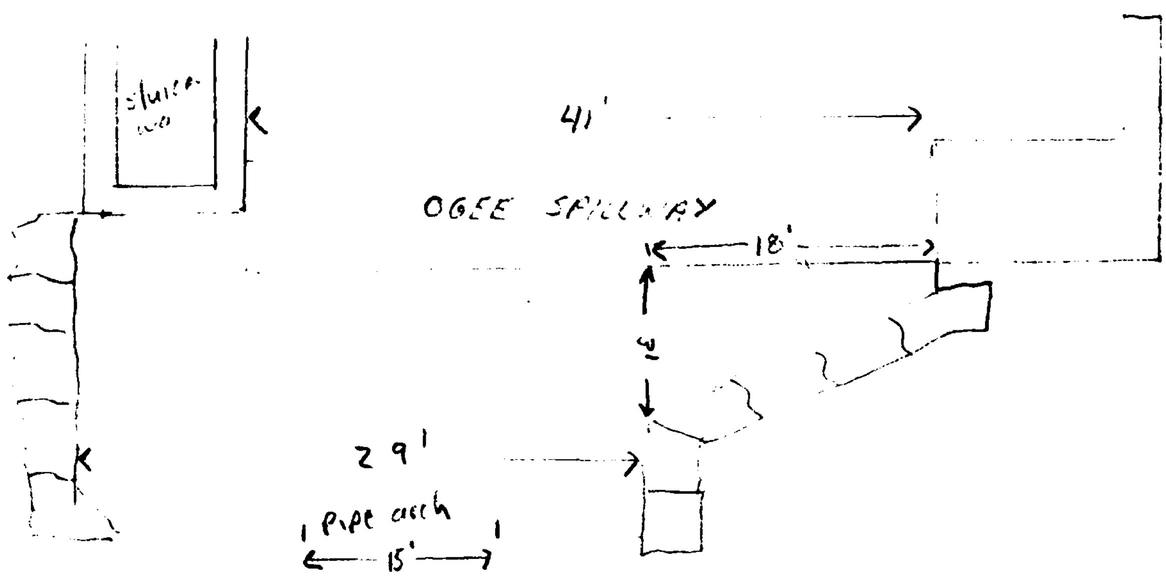
Subject CHESAM POND
RATING CURVE

Sheet No. ______ of ______
Date ______
Computed ______
Checked ______

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

- FREE OVERFLOW OGEE CREST
- CONTRACTED WINGWALL D/S ON EASTERLY SIDE
- PIPE ARCH BENEATH ROAD IMMEDIATELY D/S WILL CONTROL AT HIGH DISCHARGE

Plan of Spillway



Normal Pool = Spillway Crest = 1154 msl from quad
$L = 41'$ Take $C = 3.5$ Top of Dam = 1156.4 (low point)

$$Q = CLH^{3/2} = (3.5)(41)H^{3/2} = 143.5 H^{3/2}$$

Dam Embankment - see attached sketch.
$Q = CLH^{3/2}$ L varies with H take $C = 2.5$

- Determine when (crit) pipe arch capacity controls
Assume 31 corner radius for pipe arch

Drainage Area = 8.2 square miles
Size Classification = Small
Hazard Classification = Significant
Test Flood Range = 1/4 to 1/2 PMF
Chosen Test Flood = 1/2 PMF ; storage is in upper range of size classification and potential for loss of 4-6 lives.

STEP #1
Calculate test flood using "Preliminary Guidance for Estimating Maximum Probable Discharges in Phase I Dam Safety Inspection, March, 1978"

1/2 PMF discharge at Seaver Reservoir Dam, with a drainage area of 4.4 mi^2, was determined to be 2,660 cfs. This value was obtained from the Seaver Reservoir Dam Phase I inspection report (NH00094).

Apply guide curves to sub drainage area of 3.8 square miles. Find slope of sub DA. Length of longest watercourse 2.2 miles. Change in elevation 1520 - 1154 = 366 ft. Therefore, slope of watershed ≈ 166 ft/mi - use 'mountainous' curve to obtain csm value of 2300.

$3.8\ mi^2 \times 2300\ csm = 8{,}740\ cfs$ (PMF Inflow)

Test Flood equals 1/2 PMF ∴ 4,370 cfs

1/2 PMF Inflow to Chesham = 2,660 cfs
+ 4,370 cfs
7,030 cfs

Use <u>7,000</u> cfs as test flood inflow (Qp_1)

STEP #2a. Determine surcharge height to pass Qp_1 of 7,000 cfs. To do this a rating curve of Chesham Pond Dam must be calculated.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

CHESHAM POND DAM
HARRISVILLE, NEW HAMPSHIRE

REGIONAL VICINITY MAP

MARCH 1980

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS

ANDERSON-NICHOLS & CO., INC. CONCORD, NH.

SCALE IN MILES

0 1/2

MAP BASED ON U.S.G.S. 7.5 MINUTE QUADRANGLE SHEET. MONADNOCK, N.H. 1949.

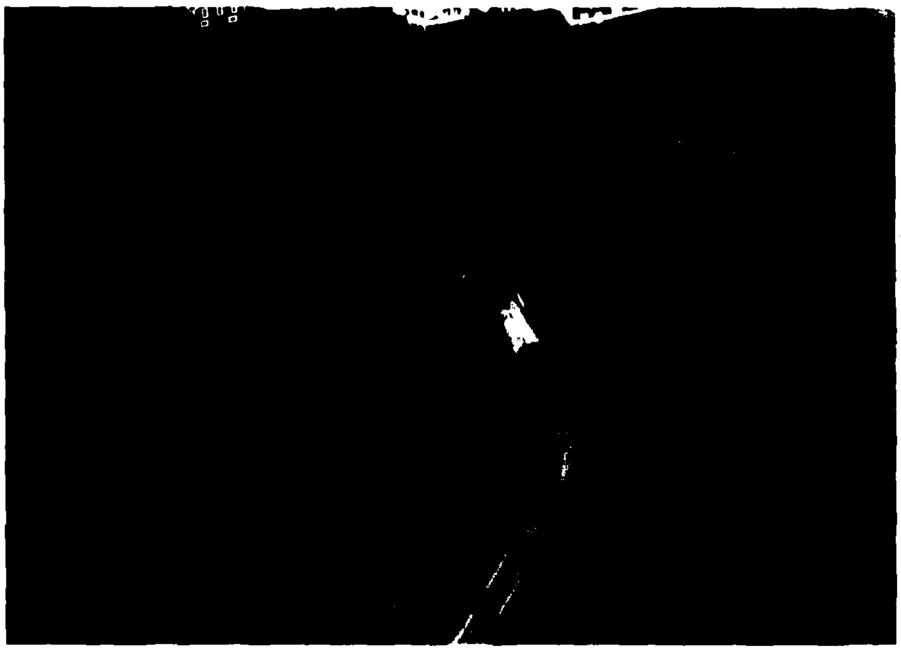
APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

October 1979

Figure 14 - Overview of the reach between the two road crossings shown in Figures 11 and 12 above.

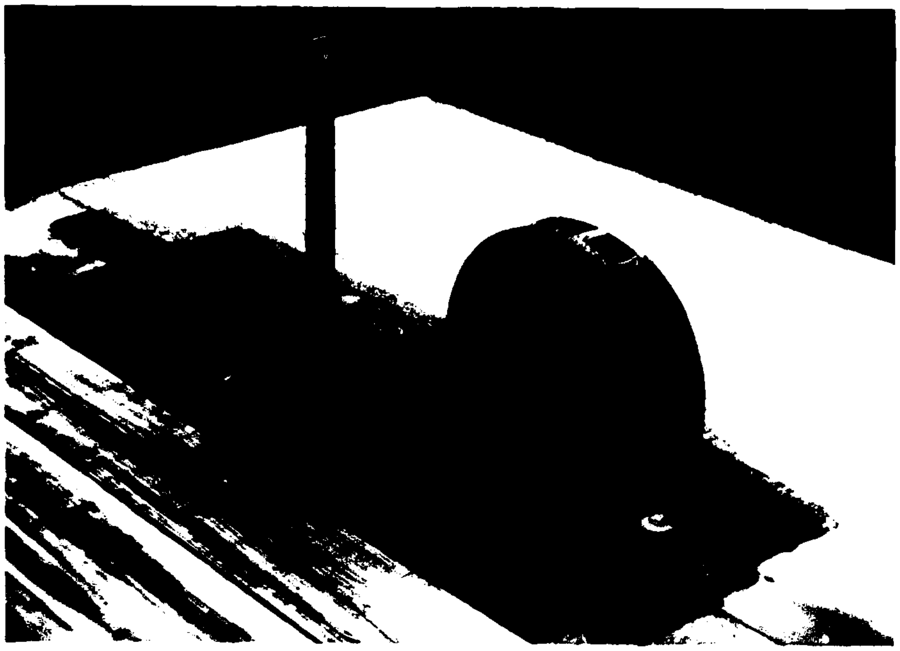
October 1979
Figure 12 - Overview of the road crossing located ½ mile downstream of the dam.



October 1979
Figure 13 - Overview of the road crossing located one mile downstream of the dam.

September 13, 1979
Figure 10 - Looking downstream at pipe arch from low-level outlet structure.

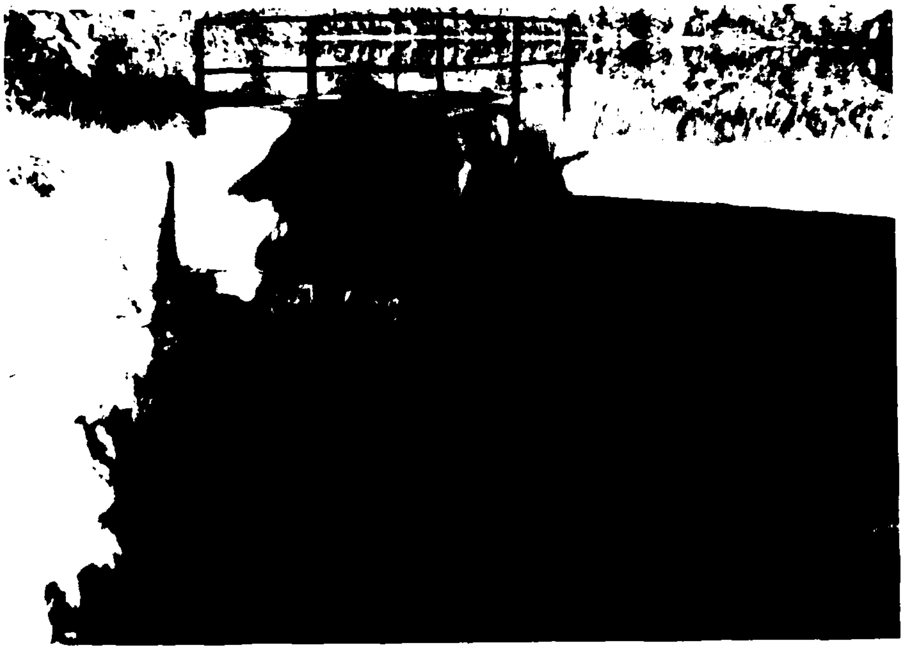
September 13, 1979
Figure 11 - View of the discharge channel downstream of the pipe arch.



September 13, 1979
Figure 8 - Looking at the control mechanism for the low-level gated outlet.

September 13, 1979
Figure 9 - Looking into the upstream reservoir from the dam.

September 13, 1979
Figure 6 - Looking southeasterly across the crest of the embankment.



September 13, 1979
Figure 7 - View of downstream face of northwest end of spillway and low-level outlet structure.

September 13, 1979

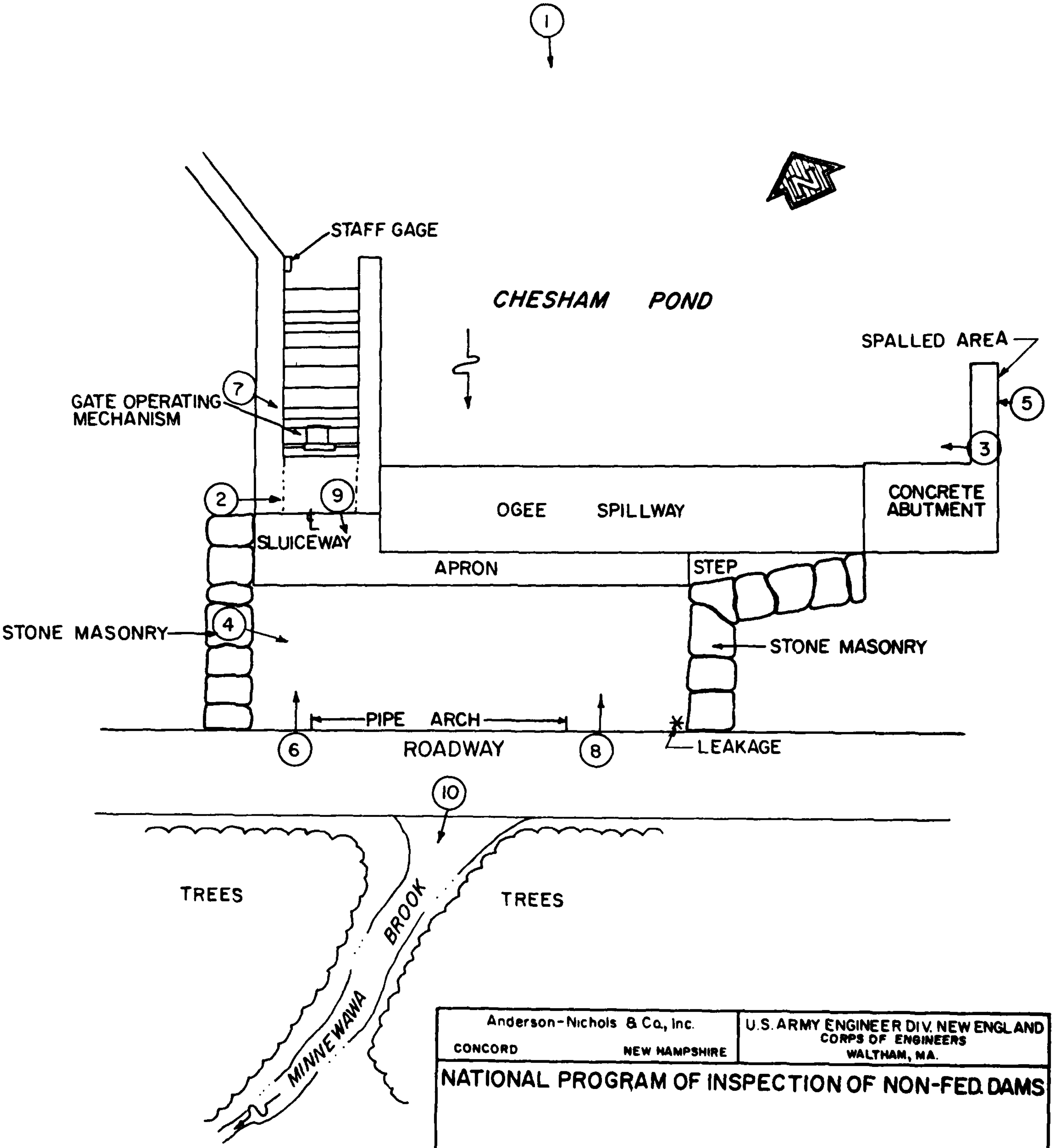
Figure 4 - Seepage at intersection of highway culvert headwall and training wall on southeast side of spillway discharge channel.

September 13, 1979

Figure 5 - Close-up of spalled area on training wall at southeast abutment.

September 13, 1979
Figure 2 - Looking southeast across crest of the dam.

September 13, 1979
Figure 3 - Looking northwest across the crest of dam.



Anderson-Nichols & Co., Inc. CONCORD NEW HAMPSHIRE	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MA.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

PHOTO INDEX

MINNEWAWA BROOK NEW HAMPSHIRE

SCALE: NOT TO SCALE

DATE: MARCH 1980

APPENDIX C

PHOTOGRAPHS

Anderson-Nichols & Company, Inc.

Subject [illegible]

JOB NO.

Sheet No. ______ of ______
Date ______
Computed ______
Checked ______

SQUARES 1/4 IN. SCALE

Devereaux Road [illegible]

Minimum elevation 1156.4 $\quad Q = 0$

- @ elev. 1156.7 $\quad L = 25 \quad$ avg $H = .2 \quad$ Take $C = 2.5$

  $Q = CLH^{3/2} = (2.5)(25)(.2)^{3/2} = 6$ cfs

- @ elev. 1157.0 $\quad L = 32 \quad$ avg $H = .4 \quad Q = (2.5)(32)(.4)^{3/2} = 20$

- @ elev. 1157.2 $\quad L = 40 \quad$ avg $H = .5 \quad Q = (2.5)(40)(.5)^{3/2} = 35$

- @ elev. 1157.5 $\quad L = 54 \quad$ avg $H = .7$ and $L = 45 \quad$ avg $H = .3$

  $Q = (2.5)(54)(.7)^{3/2} + (2.5)(45)(.3)^{3/2} = 98$

- @ elev. 1158.0 $\quad L = 60 \quad$ avg $H = .9 \quad$ and $L = 55 \quad$ avg $H = .7$ and
  $L = 24 \quad$ avg $H = .3$

  $Q = (2.5)(60)(.9)^{3/2} + (2.5)(55)(.7)^{3/2} + (2.5)(24)(.3)^{3/2} = 218$

- @ elev. 1158.5 $\quad L = 60 \quad$ avg $H = 1.4 \quad$ and $L = 65 \quad H = 1.1 \quad$ and
  $L = 30 \quad$ avg $H = .7$

  $Q = (2.5)(60)(1.4)^{3/2} + (2.5)(65)(1.1)^{3/2} + (2.5)(30)(.7)^{3/2} = 480$

- @ elev. 1159.0 $\quad L = 60 \quad$ avg $H = 1.9$ and $L = 72 \quad H = 1.5$
  $L = 36 \quad$ avg $H = 1.0$

  $Q = (2.5)(60)(1.9)^{3/2} + (2.5)(72)(1.5)^{3/2} + (2.5)(36)(1.0)^{3/2} = 814$

Anderson-Nichols & Company, Inc.

Subject

Sheet No. of
Date
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Checked

JOB NO.

SQUARES 1/4 IN. SCALE

– @ elev. 1159.5 $L=60$ $H=2.4$ and $L=85$ $H=1.9$
and $L=41$ $H=1.2$

$$Q=(2.5)(60)(2.4)^{3/2}+(2.5)(85)(1.9)^{3/2}+(2.5)(41)(1.2)^{3/2}=1249$$

– @ elev. 1160.0 $L=60$ $H=2.9$ and $L=96$ $H=2.2$
and $L=48$ $H=1.6$

$$Q=(2.5)(60)(2.9)^{3/2}+(2.5)(96)(2.2)^{3/2}+(2.5)(48)(1.6)^{3/2}=1767$$

– @ elev 1161.0 $L=60$ $H=3.9$ and $L=180$ $H=2.5$
and $L=70$ $H=2.2$

$$Q=(2.5)(60)(3.9)^{3/2}+(2.5)(180)(2.5)^{3/2}+(2.5)(70)(2.2)^{3/2}=3505$$

– @ elev. 1162.0 $L=60$ $H=4.9$ and $L=140$ $H=2.8$
and $L=97$ $H=2.7$

$$Q=(2.5)(60)(4.9)^{3/2}+(2.5)(140)(2.8)^{3/2}+(2.5)(97)(2.7)^{3/2}=4343.$$

– @ elev. 1163.2 $L=60$ $H=6.1$ and $L=160$ $H=3.5$
and $L=132$ $H=3.5$

$$Q=(2.5)(60)(6.1)^{3/2}+(2.5)(160)(3.5)^{3/2}+(2.5)(132)(3.5)^{3/2}=7040$$

@ elev. 1164.0 $L=60$ $H=6.9$ and $L=190$ $H=4.1$
and $L=155$ $H=4.1$

$$Q=(2.5)(60)(6.9)^{3/2}+(2.5)(190)(4.1)^{3/2}+(2.5)(155)(4.1)^{3/2}=9879$$

@ elev. 1165.0 $L=60$ $H=7.9$ and $L=210$ $H=4.8$
and $L=185$ $H=4.8$

$$Q=(2.5)(60)(7.9)^{3/2}+(2.5)(210)(4.8)^{3/2}+(2.5)(185)(4.8)^{3/2}=13715$$

Anderson-Nichols & Company, Inc.

Subject RATING DATA

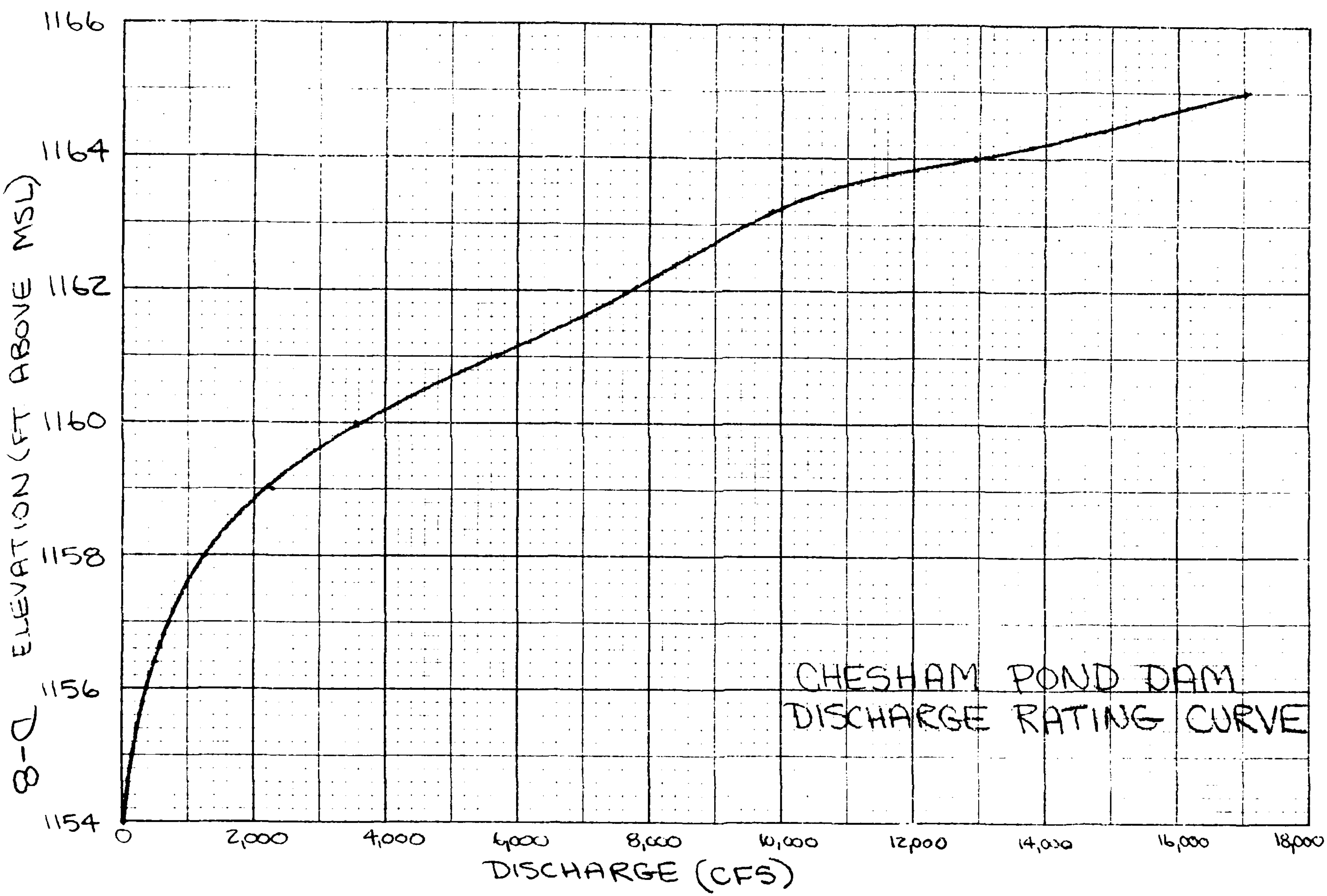
JOB NO. CHESAIY POND

Sheet No. ______ of ______
Date ______
Computed ______
Checked ______

ELEVATION	SPILLWAY			SLUICEWAY		PIPE ARCH			DAM CREST	COMBINED
(FT)	L	H	Q	H	Q	Q	H	ELEV.	Q	Q
1154.0	41	0	0							0
1154.2	41	.2	13							13
1154.5	41	.5	51							51
1155.0	41	1.0	144							144
1155.7	41	1.7	318							318
1156.4	41	2.4	534						0	534
1156.7	40	2.7	621						6	627
1157.0	39	3.0	709						20	729
1157.2	39	3.2	781	0	0	781	7.3	1148.1	35	816
1157.5	38	3.5	871	.3	4	875	7.9	1148.7	98	873
1158.0	37	4.0	1036	.8	19	1055	8.9	1149.7	218	1273
1158.5	36	4.5	1203	1.3	39	1242	10.2	1151.0	480	1722
1159.0	35	5.0	1409	1.8	63	1472	11.3	1152.1	814	2286
1159.5	34	5.5	1535	2.3	91	1626	12.3	1153.1	1249	2875
1160.0	33	6.0	1697	2.8	123	1820	13.8	1154.6	1747	3587
1161.0	32	7.0	2074	3.8	194	2168	16.3	1157.1	3505	5673
1163.2*						2809	22.4	1163.2*	7040	9849
1164.0						3100	23.2	1164.0	9879	12979
1165.0						3300	24.2	1165.0	13715	17015

* PIPE ARCH CONTROLS AT AND ABOVE THIS ELEVATION

Using the above trials establish a discharge rating curve for the dam.



CHESHAM POND DAM
DISCHARGE RATING CURVE
ELEVATION (FT ABOVE MSL)
1154
1156
1158
1160
1162
1164
1166
DISCHARGE (CFS)
0
2,000
4,000
6,000
8,000
10,000
12,000
14,000
16,000
18,000

$Q_{P1} = 7{,}000$ cfs $\Rightarrow$ elevation 1161.6' MSL

STEP #2b Determine the volume of surcharge in inches of runoff. To do this a storage vs elevation curve must be determined. (See pages).

$Q_{P1} \Rightarrow 7{,}000$ cfs $\Rightarrow$ 1161.6' MSL $\Rightarrow$ 1200 AC-FT
Normal Storage (spillway crest) $\Rightarrow$ 460 AC-FT

$740 \text{ AC-FT} \times \frac{1}{8.2 \text{ mi}^2} \times \frac{1 \text{ mi}^2}{640 \text{ AC}} \times \frac{12 \text{ in}}{\text{ft}} = 1.69''$ runoff (STOR1)

STEP #2c

$Q_{P2} = Q_{P1}\left(1 - \frac{\text{STOR 1}}{9.5}\right) = 7{,}000\left(1 - \frac{1.69''}{9.5''}\right) = 5{,}750$ cfs

STEP #3a Determine surcharge height and STOR 2 to pass Q_{P2}
5,750 cfs $\Rightarrow$ 1161' MSL $\Rightarrow$ 1110 AC-FT
$650 \text{ AC-FT} \times \frac{1}{8.2 \text{ mi}^2} \times \frac{1 \text{ mi}^2}{640 \text{ AC}} \times \frac{12 \text{ in}}{\text{ft}} = 1.49''$ runoff (STOR2)

STEP #3b Average STOR1 & STOR2 and determine Q_{P3}
$1.69'' + 1.49'' = 3.18 \div 2 = 1.59''$ runoff $= 0.13'$
$0.13' \times \frac{8.2 \text{ mi}^2}{1} \times \frac{640 \text{ AC}}{\text{mi}^2} = 682$ AC-FT
682 AC-FT + 460 AC-FT = 1142 AC-FT $\Rightarrow$ 1161.2' MSL
1161.2' MSL $\Rightarrow$ 6,000 cfs $\Rightarrow$ Routed test flood outflow

---

Top of dam = 1156.4' MSL therefore dam will be overtopped by 4.8 feet during test flood. Maximum spillway capacity at top of dam is 535 cfs which is only 9 percent of the routed test flood outflow.

Anderson-Nichols & Company, Inc. Subject CHESAM POND

Sheet No. ______ of ______
Date ______
Computed ______
Checked ______

JOB NO.

STORAGE - ELEVATION

- FROM KEENE GAS-ELECTRIC DATA

@ Normal Pool el. 1154 A = 70 ac Vol = 20 mil ft^3
= 460 ac-ft

- Total draw 14' - Take invert of dam @ 1140.0

- FROM PLANIMETER

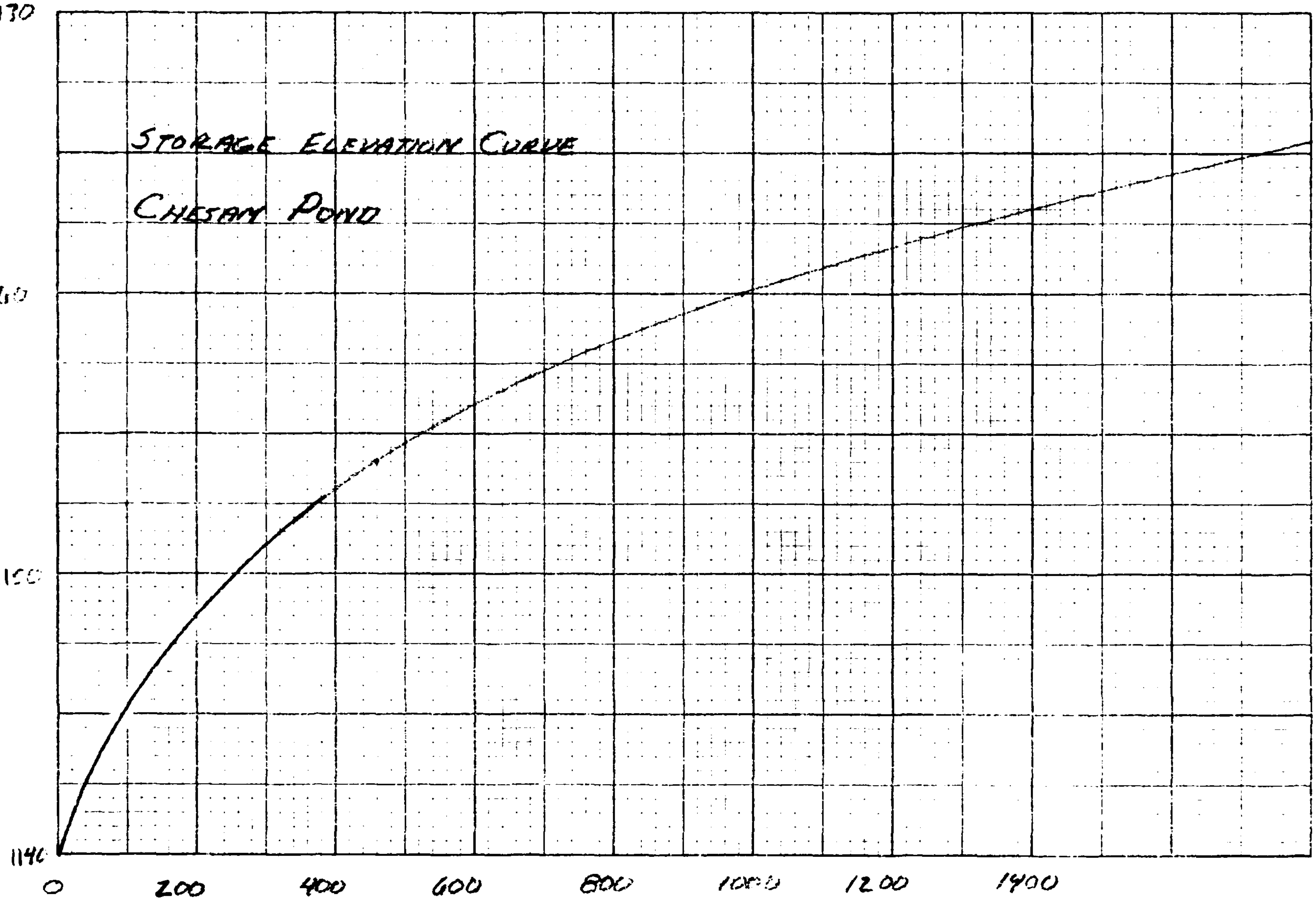
@ contour 1160 A = 105 ac.

$$\Delta S = \frac{105 + 70}{2} \times 6 = 525 \text{ ac ft}$$

Total = 525 + 460 = 985

Storage-Elevation Points

el.	Storage
1140	0
1154	460
1160	985

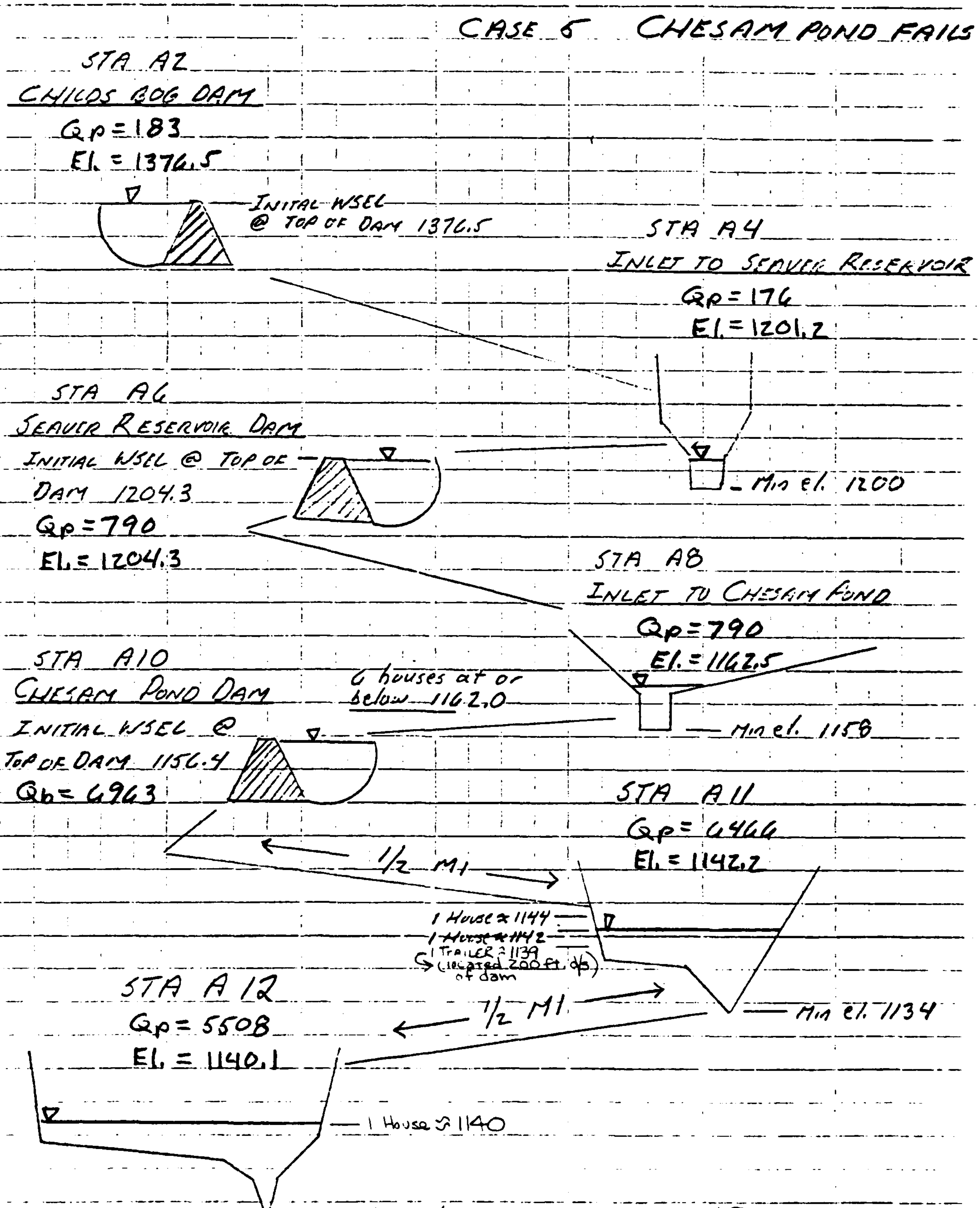

STORAGE ELEVATION CURVE
CHESAM POND
1130
1160
1150
1140
0
200
400
600
800
1000
1200
1400

on-Nichols & Company, Inc.

Subject BREACH ANALYSIS

JOB NO. HEC-1 SUMMARY SCHEMATICS

Sheet No. ______ of ______
Date ______
Computed ______
Checked ______



CHESHAM FAILS

```
**************************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION       JULY 1978
 LAST MODIFICATION  26 FEB 79
**************************************
A1 CHILDS BOG - SEAVER RESERVOIR - CHESAM POND  DOWNSTREAM HAZARD EVALUATION
A2 NEW HAMPSHIRE DAM NUMBERS  00096,
A3 SEGMENT 3  ROUTE [redacted] INFLOW HYDROGRAPH FROM SEAVER [redacted] THROUGH CHESAM
B     100       0       5       0       0       0       0       0       0       0
B1      5
J       2       1       1
J1      1
K       0      AP                                       1
K1 ROUTED [redacted] HYDROGRAPH FROM SEAVER USED AS INFLOW TO CHESAM
M      -1                                                                1
N     540.    562.    840.    649.    710.    638.    639.    603.    588.    564.
N     545.    525.    506.    488.    471.    454.    438.    423.    408.    394.
N     381.    360.    356.    344.    332.    321.    311.    301.    291.    282.
N     273.    264.    256.    248.    240.    233.    226.    222.    219.    216.
N     213.    209.    206.    203.    200.    197.    194.    191.    188.    185.
N     182.    179.    177.    174.    171.    169.    166.    164.    161.    159.
N     156.    154.    151.    149.    147.    144.    142.    140.    138.    136.
N     134.    132.    130.    128.    126.    124.    122.    120.    118.    117.
N     115.    113.    111.    110.    108.    106.    105.    103.    101.    100.
N      98.     97.     95.     94.     92.     91.     90.     88.     87.     86.
K       1     A10                                       1
K1 ROUTE COMBINED HYDROGRAPH THROUGH CHESAM POND
Y                               1       1
Y1      1                                         -1156.4      -1
Y4 1154.  1154.2  1154.5   1155.  1155.7  1156.4  1156.7   1157.  1157.2  1157.5
Y4 1158.  1158.5   1159.  1159.5   1160.   1161.  1163.2   1164.   1165.
Y5     0.     13.     51.    144.    318.    534.    627.    729.    816.    873.
Y5 1273.   1722.   2286.   2875.   3587.   5673.   984.9  12979.  17015.
$S     0.    180.    300.    460.    630.    700.    985.   1320.   1430.   1800.
$E 1140.   1148.   1151.   1155.  1156.4  1157.2   1160.  1162.5  1163.2  1165.5
$$ 1154.
$D1156.4
$B    50.      0.   1140.     1.0  1156.4  1156.4
$B    50.      0.   1140.     1.0  1156.4   1170.
K       1     A11                                       1
K1 ROUTE HYDROGRAPH DOWN MINNEWAWA BROOK FOR 1/2 MILE
Y                               1       1
Y1      1
Y6     .1     .04      .1   1134.   1155.   2500.   .0024
Y7    550.   1155.    700.   1140.    880.   1138.   1000.   1134.   1020.   1138.
Y7   1050.   1140.   1200.   1150.   1280.   1155.
K       1     A12                                       1
K1 ROUTE HYDROGRAPH DOWN MINNEWAWA BROOK FOR ANOTHER 1/2 MILE
Y                               1       1
Y1      1
Y6    .08     .03     .03   1130.   1145.   2500.   .0016
Y7    950.   1145.   1000.   1140.   1900.   1138.   1980.   1134.   2000.   1130.
Y7   2020.   1134.   2080.   1140.   2105.   1145.
K       1     A13                               1
K1 ROUTE HYDROGRAPH ANOTHER 7000 FT DOWN MINNEWAWA BROOK
```

```
Y1     1
Y6    .1     .05     .1    1075.   1120.   7000.   .008
Y7  850.   1120.    900.   1100.    980.   1080.    990.   1075.   1010.   1075.
Y7 1020.   1080.   1150.   1100.   1200.   1120.
K     99
```

D-14

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1156.40	1154.00	1156.40
STORAGE	630.	420.	630.
OUTFLOW	534.	0.	534.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	1156.40	0.00	630.	6963.	0.00	1.00	0.00

PLAN 2 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1156.40	1154.00	1156.40
STORAGE	630.	420.	630.
OUTFLOW	534.	0.	534.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	1156.47	.07	636.	555.	1.67	.83	0.00

D-15

PLAN 1 STATION A11

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
1.00	6466.	1142.2	1.08

PLAN 2 STATION A11

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
1.00	552.	1137.4	1.17

PLAN 1 STATION A12

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
1.00	5508.	1140.1	1.25

PLAN 2 STATION A12

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
[illegible]	[illegible]	[illegible]	[illegible]

PLAN 1 STATION A13

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
1.00	5168.	1086.0	1.50

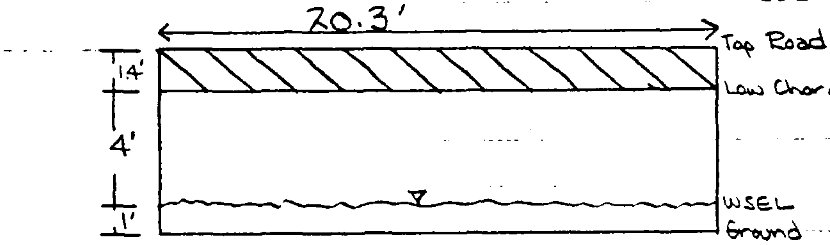
PLAN 2 STATION A13

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
1.00	590.	1078.6	1.92

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29

Evaluate capacity of box culvert located about ½ mile downstream of Chesham Dam.

Road width = 35'



Use the orifice equation to determine the capacity of the culvert at top of road.

$$Q = CA\sqrt{2gh}$$
$$Q = (0.8)(101.5)\sqrt{64.4 \times 3.2} = \underline{1{,}165} \text{ cfs}$$

Breach Q through reach ≈ 6,470 cfs. Therefore, the culvert will not carry the breach Q. Weir flow will occur over the road along with pressure flow through the culvert. Develop a rating curve for the weir cross section shown on Sheet 3. Use weir equation $Q = CLH^{3/2}$, where $C \approx 2.7$.

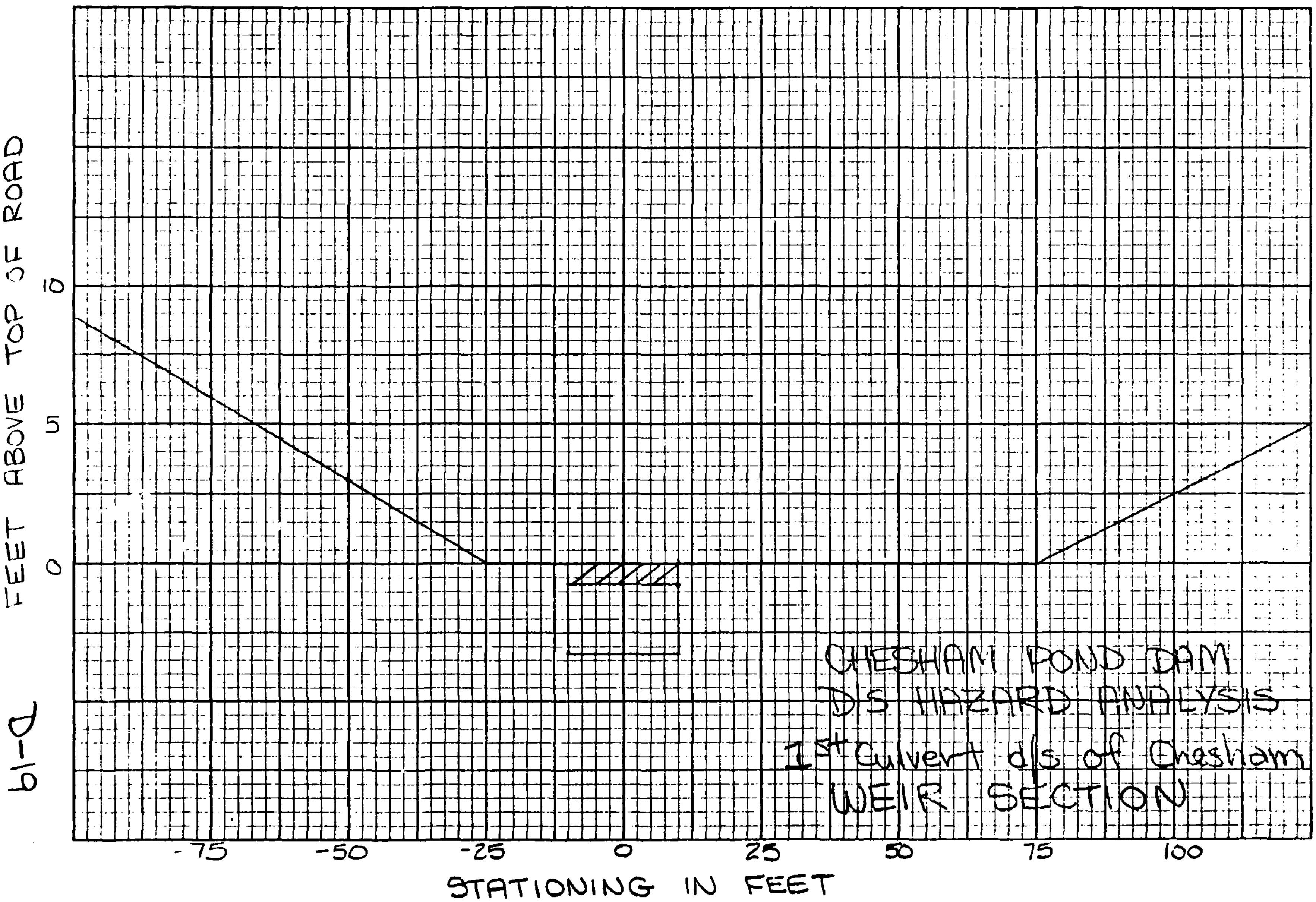
Stage (ft. above invert)	Discharge (cfs)
0	0
6.4 (top road)	$Q_{ORIFICE} = 1{,}165$
7.4	$Q_{ORIFICE} = (0.8)(101.5)\sqrt{64.4 \times 4.2}$ $Q_{ORIFICE} = 1{,}335$ $Q_{weir} = 2.7(100)(1.0)^{3/2} + 2.7(10)(1.0)^{3/2} = 297$ $Q_{TOTAL} = 1{,}632$

2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

Stage	Discharge (cfs)
8.4	$Q_{ORIFICE} = (0.8)(101.5)\sqrt{64.4 \times 5.2} = 1485$ $Q_{WEIR} = 2.7(100)(2.0)^{3/2} + 2.7(\tfrac{1}{2}16)(2.0)^{3/2} + 2.7(\tfrac{1}{2}20)(2.0)^{3/2} = 901$ $Q_{TOTAL} = 2{,}386$
9.4	$Q_{ORIFICE} = (0.8)(101.5)\sqrt{64.4 \times 6.2} = 1{,}623$ $Q_{weir} = 2.7(100)(3.0)^{3/2} + 2.7(\tfrac{1}{2}25)(3.0)^{3/2} + 2.7(\tfrac{1}{2}30)(3.0)^{3/2} = 1{,}789$ $Q_{TOTAL} = 3{,}412$
11.4	$Q_{ORIFICE} = (0.8)(101.5)\sqrt{64.4 \times 8.2} = 1{,}866$ $Q_{weir} = 2.7(100)(5.0)^{3/2} + 2.7(\tfrac{1}{2}41)(5.0)^{3/2} + 2.7(\tfrac{1}{2}50)(5.0)^{3/2} = 4{,}392$ $Q_{TOTAL} = 6{,}258$
12.4	$Q_{ORIFICE} = (0.8)(101.5)\sqrt{64.4 \times 9.2} = 1{,}976$ $Q_{weir} = 2.7(100)(6.0)^{3/2} + 2.7(\tfrac{1}{2}50)(6.0)^{3/2} + 2.7(\tfrac{1}{2}60)(6.0)^{3/2} = 6{,}151$ $Q_{TOTAL} = 8{,}127$

)sing the above trials, establish a stage/discharge curve. (See Sheet 4.)

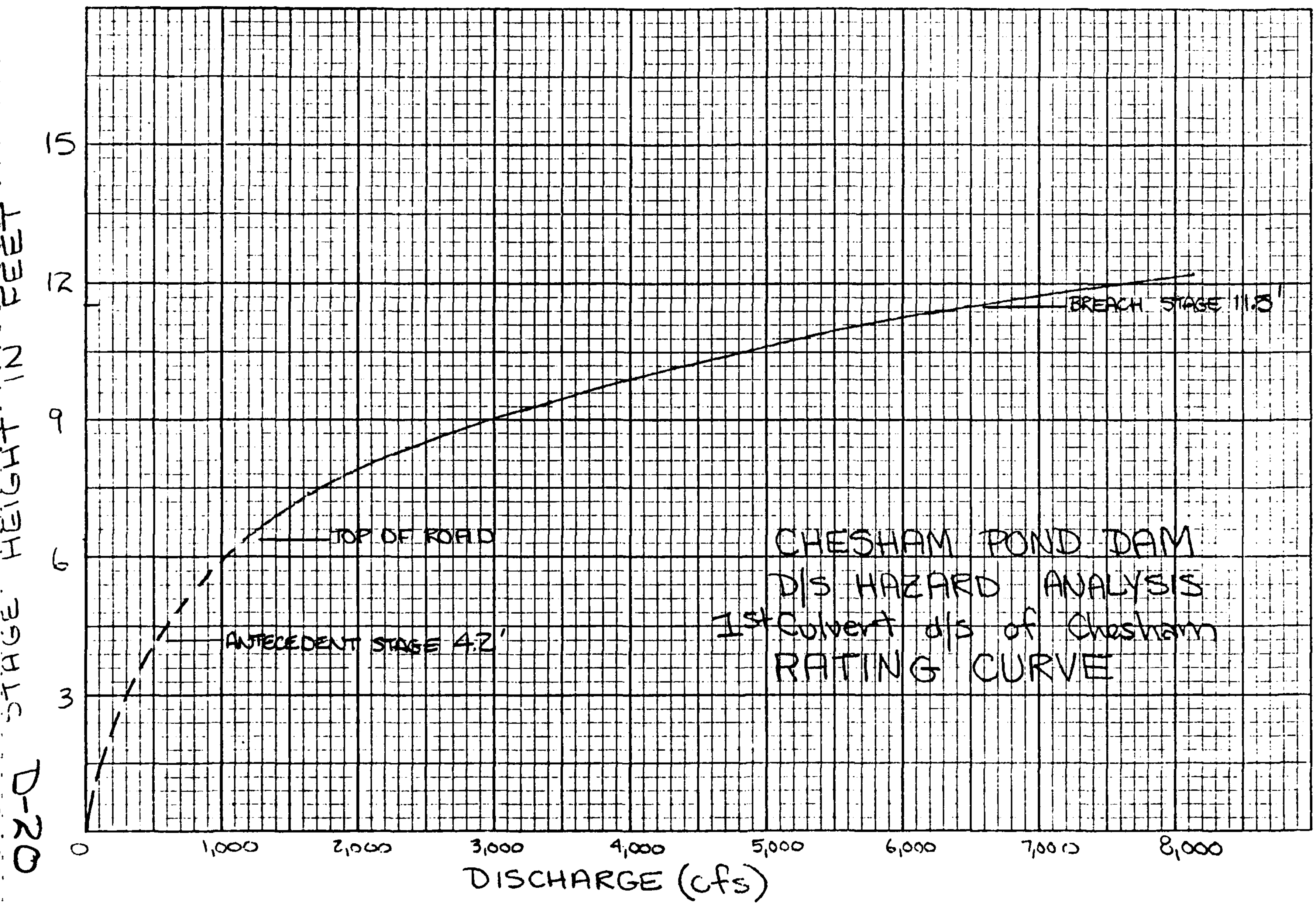
Breach Q = 6,470 cfs Stage = 11.5 feet
ntecedent Q = 535 cfs Stage = 4.2 feet
ncrease due to breach would be 7.3 feet. This
crease could cause property damage to two house
ated on the right bank of the channel. Loss
life would probably not occur. Damage to
roadway and the structure could occur.
e road would be overtopped by about 5.1 feet
water. One trailer/shack located 200 feet d/s
the dam could be inundated by 3.2 feet of
ter. Loss of 1 or 2 lives is possible. (See HEC-1
mmary Schematic)



Sheet 3/8
L. Williams

D-19

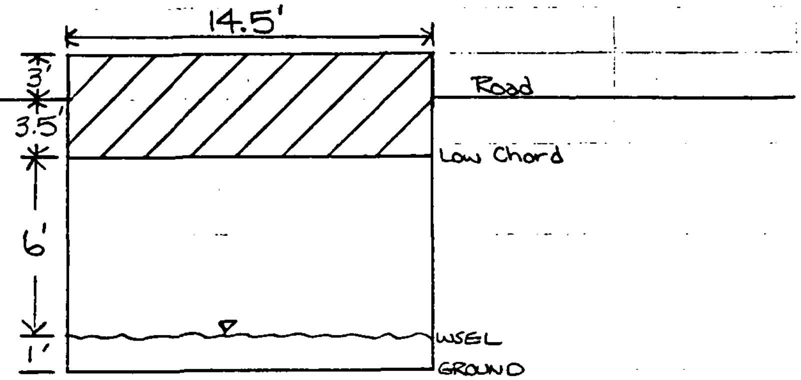
Sheet 4/8
L. Williams



Evaluate capacity of box culvert located about one mile downstream of Chesham Pond Dam.

Road width = 18'

Gravel Road on left side



Use the orifice equation to determine the capacity of the culvert at top of road.

$$Q = CA\sqrt{2gh}$$

$$Q = (0.8)(101.5)\sqrt{64.4 \times 5.25} = 1{,}493 \text{ cfs}$$

Breach Q through reach ≈ 5,500 cfs. Therefore, culvert will not carry breach Q. Weir flow will occur over the road along with pressure flow through the culvert. Develop a rating curve for the weir cross section shown on Sheet 7. Use weir equation $Q = CLH^{3/2}$ to rate flow over roadway. Assume 'c' is ≈ 2.7.

Stage (ft. above invert)	Discharge (cfs)
0	0
10.5 (top of road)	$Q_{ORIFICE} = 1{,}493$
11.5	$Q_{ORIFICE} = (0.8)(101.5)\sqrt{64.4 \times 6.25} = 1629$ $Q_{weir} = 2.7(211)(1.0)^{3/2} + 2.7(\tfrac{1}{2}20)(1.0)^{3/2} + 2.7(\tfrac{1}{2}5)(1.0)^{3/2} = 603$ $Q_{TOTAL} = 2096$ cfs

Stage (ft. above invert)	Discharge (cfs)
12.5	$Q_{ORIFICE} = (0.8)(101.5)\sqrt{64.4 \times 7.25} = 1{,}755$ $Q_{weir} = 2.7(211)(2.0)^{3/2} + 2.7(\tfrac{1}{2}41)(2.0)^{3/2} + 2.7(\tfrac{1}{2}10)(2.0)^{3/2} = 1{,}806$ $Q_{TOTAL} = 3{,}561$ cfs
14.0	$Q_{ORIFICE} = (0.8)(101.5)\sqrt{64.4 \times 8.75} = 1{,}928$ $Q_{weir} = 2.7(211)(3.5)^{3/2} + 2.7(\tfrac{1}{2}75)(3.5)^{3/2} + 2.7(\tfrac{1}{2}16)(3.5)^{3/2} = 4{,}535$ $Q_{TOTAL} = 6{,}463$

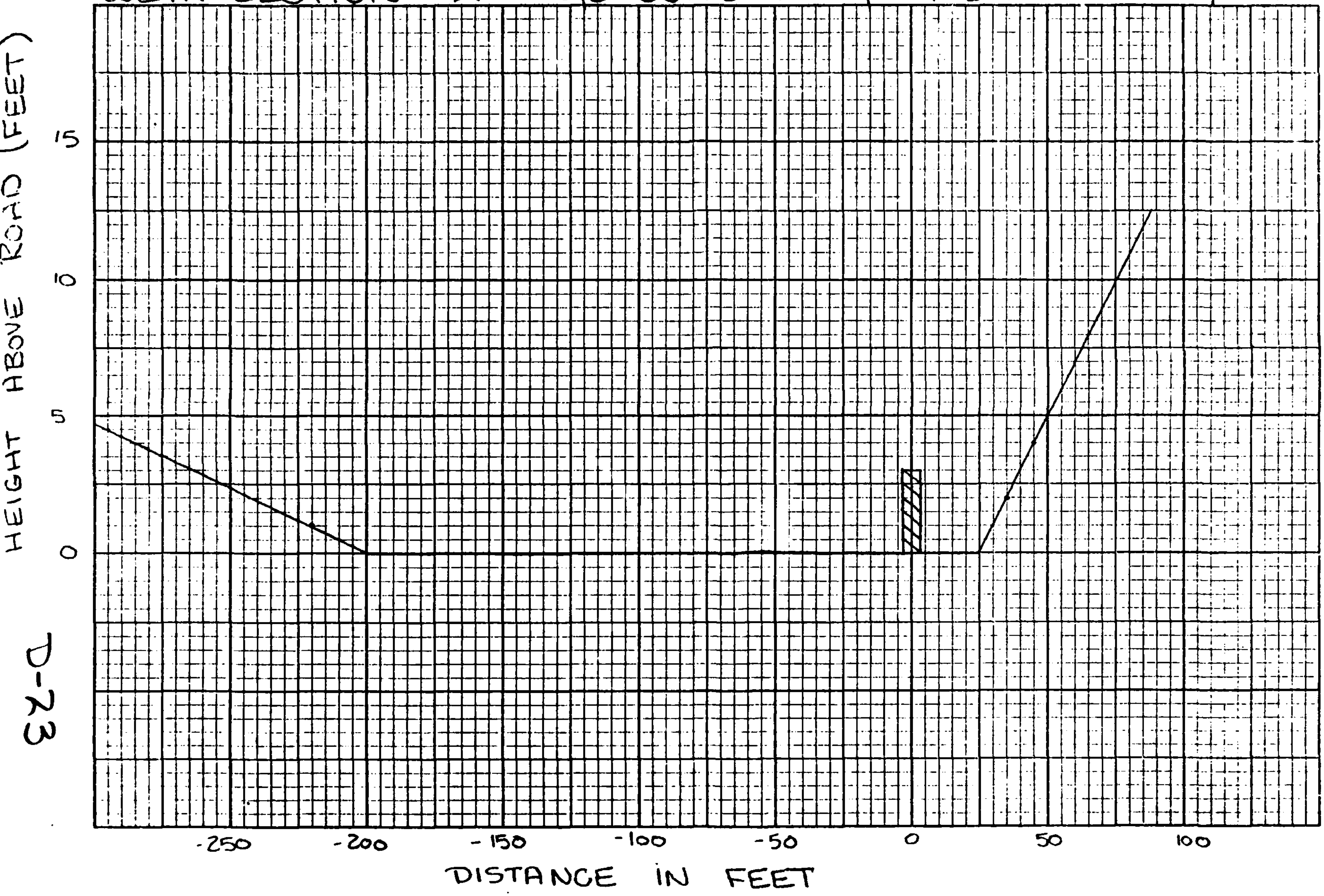
Using the above trials, establish a stage/discharge relationship. See curve on sheet 8.

Breach Q = 5,500 cfs Stage = 13.5 feet
Antecedent Q = 535 cfs Stage = 5.2 feet
Increase due to breach would be = 8.3 feet. This would result in the gravel roadway being overtopped by 3 feet. One house located in this reach may suffer some property damage. Loss of life is unlikely. A large storage area exists in this reach; the wave would be attenuated in this area. The 2ND road crossing would act as a dam and would fill up this area. After overtopping of the roadway, the lessened breach discharge would continue downstream.

This analysis, in conjunction with the HEC-1 analysis, supports the appropriate hazard classification of Chesham as Significant. A breach could possibly result in the loss of 1-2 lives and could cause appreciable property damage.

CHESHAM POND DAM

WEIR SECTION - 2ND d/s culvert - D/s HAZARD ANALYSIS

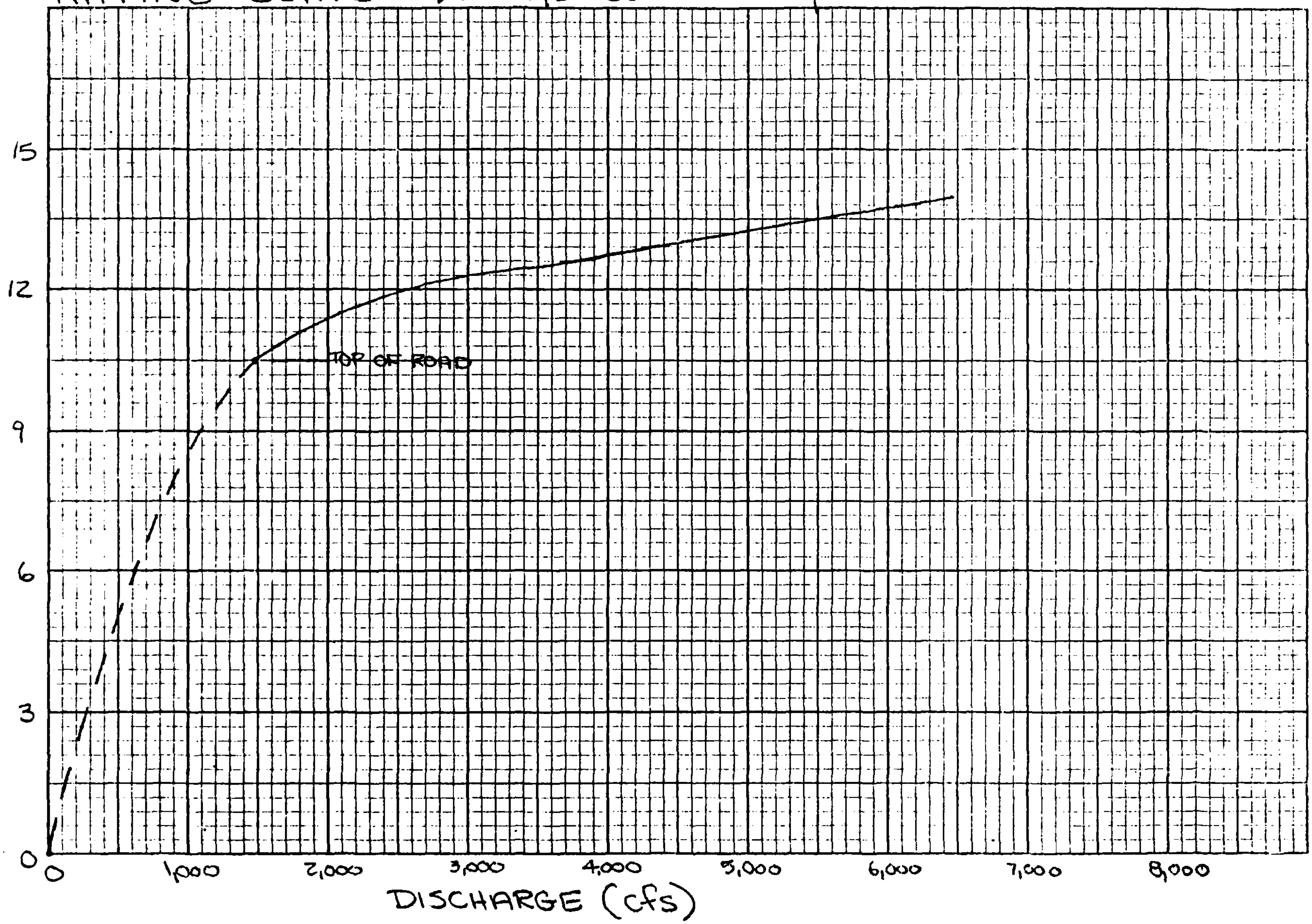


Sheet 7/8
L. Williams
-/10/80

D-23

CHESHAM POND DAM

RATING CURVE - 2ND d/s culvert - D/S HAZARD ANALYSIS



Sheet 8/8
L. Williams
4/10/80

APPENDIX E

INFORMATION AS
CONTAINED IN THE NATIONAL
INVENTORY OF DAMS

NOT AVAILABLE AT THIS TIME

END

FILMED

8-85

DTIC